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# AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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## The Acme Automatic Safety Engine.

In our issue of January 16 we published a reference to a new small engine and boiler, with which kerosene oil was used as fuel, then being perfected at the Rochester Machine Tool Works, Rochester, N. Y. With this we show two views of the machine.

The engine is vertical double-cylinder with cranks at 180°. The piston is one-half the stroke in length, no other guides being used. The wrist pin is in the piston slightly below the center, the packing rings being above the pin. The cylinders are directly over the shaft so that the engine may be run in either direction. The crank shafts are steel, with main bearings 2½ diameters in length.

The valve is of the rocking type, and placed top of the cylinders, the casing forming the cylinder head. In this way long ports are conveniently secured. The travel of this valve is controlled by a governor of simple construction situated in the fly-wheel, thus regulating the speed automatically.

Lubrication is provided by carrying in the crank case a mixture of water and oil, on the Westinghouse plan. The crank dips in this at every revolution; this oils thoroughly all parts inside the case. As the oil cannot escape from the case it is used over and over; the oil supplied to the main bearings is caught by wipers and returned to the case. The eccentric rod strap and bearing, and the outer bearing of the valve stem are the only bearings not constantly flooded with oil while the engine is running.

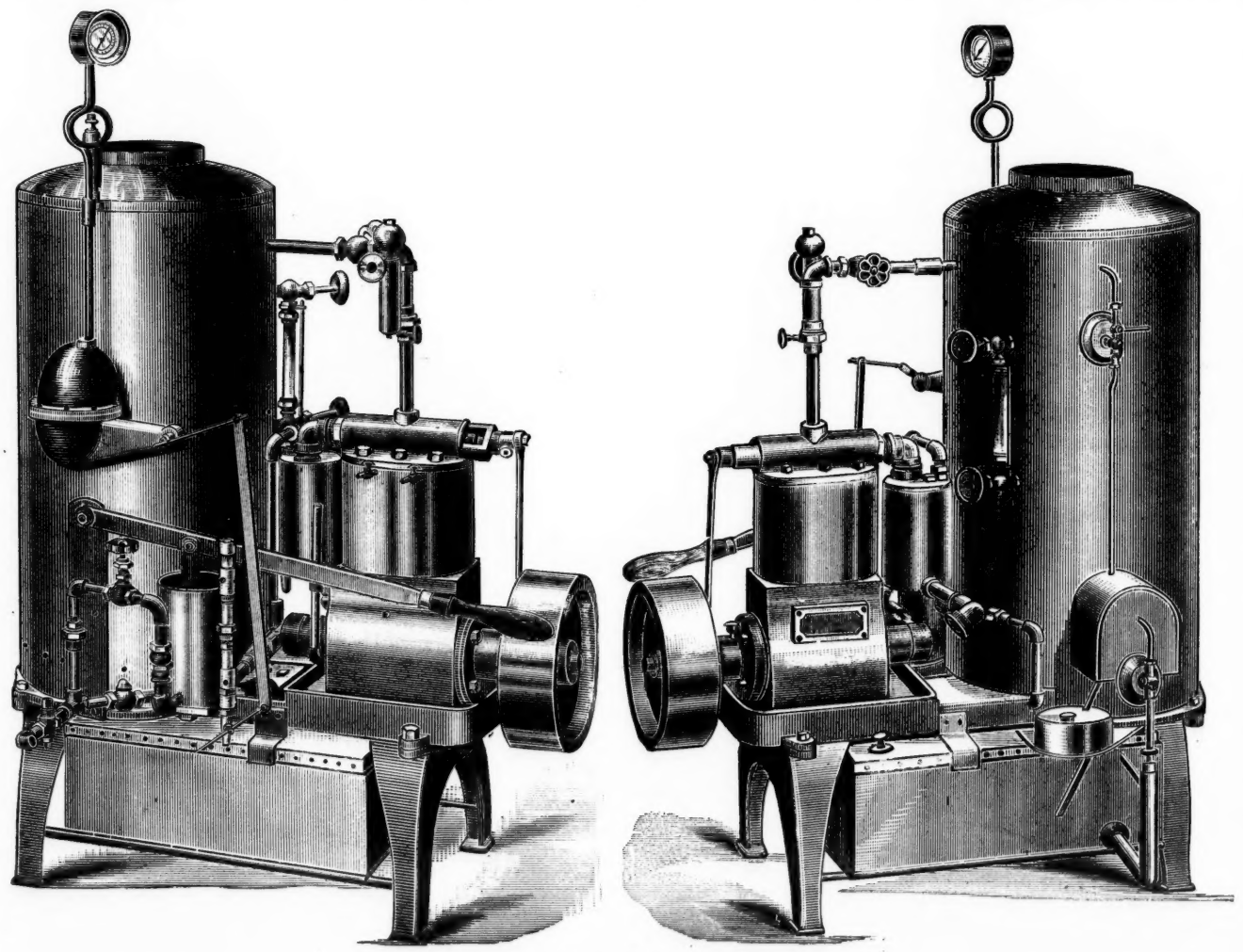
The boiler is of the sectional type, designed for securing rapid circulation. Water space below the fire is provided for the settlement of sediment, from which it can be blown out or removed when the boiler is cold. The water is carried in a series of rings connected by inclined tubes that break joints, so that the fire must search every part. The boiler is double-jacketed to prevent loss from radiation. The top ring of the boiler is larger than the others and constitutes a steam dome. The water supply is maintained by a pump worked directly from main shaft. This pump forces the feed water through a coil heater.

The supply of water is regulated by a ball float in a case attached to the boiler; this by means of levers automatically controls the supply.

The fuel used is kerosene oil of 110° to 115° fire test. The oil is atomized by a steam jet, and the supply is controlled by an automatic regulator. This reduces the supply to the requirements, or entirely shuts it off if the steam pressure reaches the limit.

These engines are adapted to any kind of light power; the boilers are tested to several times the pressure required, and all convenient and safety appliances furnished. The interchangeable system of manufacture is employed, and each engine is set up and tested before shipment. When desired for small boats link motion is provided.

For the stationary engines the intention is to make them standard.



ACME AUTOMATIC SAFETY ENGINE.

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If you have cause to borrow a tool twice, then buy one of your own. The "chronic borrower" is a man to be dreaded by all his shop mates.

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The North Hudson Railroad Company are warming their cars by means of hot water. A system of 4-inch pipes are placed under the seats, and are filled with hot water before the car leaves the station.

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When stretching two lines at right angles with each other, they may be quickly squared by placing underneath the lines a board, across which has been stretched two fine threads, or wires, perpendicular to each other. One thread may be brought to correspond with one of the lines, and the remaining line can be sighted to align with the remaining thread on the board. With a board three feet square, reasonable accuracy may be secured.

## Machine Shop Time and Cost Accounts.

BY HENRY METCALFE.

I beg to suggest the enclosed "unit card" (page 2), as an improvement on the plan described by A. J. Shaw in your issue of April 3.

These are supposed to be made up into little books, like check books, stamped with the workman's name, shop number and rate. All he has to do is to fill in number of order, piece on which working, kind of work and hours, as shown. Even this much writing can be abbreviated by using symbols for pieces and kind of work, as described in my book on cost of manufactures, from which I have adapted the example to Mr. Shaw's simple illustration.

The books take the place of time checks, being given out to the men when they come to work, and are returned to the foreman at quitting time, or when leaving the shop between times. One card is filled out for every distinct job each man has worked on. Thus, if he has worked on ten different jobs, he fills out ten cards; at 6 P. M. hands book to foreman, who verifies it, tears out checks, stamps them with rubber dater as a sign of his approval, and keeps the book until the workman calls for it next morning.

The cards pass on to the office, where they are sorted, if necessary, by names, and credit given to the men for such parts of days as each has worked. In the time-book there is no reference to jobs; it is merely an account for the purpose of paying men what is due them.

The cards are then sorted by jobs (order numbers), and are placed in pig[eon-holes] corresponding to the job numbers. [Previously] to this, the aggregate [hours on] cards can be charged to the ord[er] keep the office daily advised of [what] the order is costing). When the jo[b is complete] the cards are taken out of the pigeon[-holes] and are sorted first by pieces; that is, th[ose] bearing the name of the same piece of order, No. 2147, say *spindles*, are placed in one pile, then each of these piles in turn is sorted according to the kind of work shown on them, and each pile representing one kind of work according to rates of wages. You thus get the total number of hours at each rate on each kind of work on each component piece of each order. Split it fine or coarse, it is all there.

There is no clerical work involved. A clever boy can do, and has done, the sorting for a pretty good sized shop. If symbols are used, so that the same piece or operation is always called by the same name, he need know nothing of the workings of the shop.

The number of pieces worked on, need not appear daily, nor is it necessary that the person for whom made should be known to the workman. All these data are known from the record of order No. 2147. It complicates things to have material recorded on labor cards. It is best treated on separate and independent cards, which can be issued for requisition and all sorts of purposes. However, I will confine myself to Mr. Shaw's comparatively simple problem of getting at cost of work.

When material which cannot be charged to any particular job is purchased, it is charged to the account of the shop where it is principally used. As the foreman of that shop uses it up on jobs, he credits his shop account with what he takes on the same card on which he reports his expenditure of material on the job. The cards are sorted according to jobs having charges against them, and are filed in pigeon-holes and sorted like the labor cards.

At the end of the year the foreman's account stands like this:

| | DR. | CR. |
|---|---|---|
| Per last year's inventory..... | a. | |
| Bought during year and charged to account..... | b. | |
| Used up on jobs during year, cred. on material card..... | | c. |
| Per this inventory ..... | | d. |
| Balance, charges omitted, lost, wasted, stolen, the effects of imperfect management ..... | e. | |
| Totals..... | ..... | .. |

The balance (e), plus miscellaneous labor charges, such as attendance, oilers, superintendence and rent, insurance, repairs and [illegible]es, makes up the general shop account for [illegible]es, which, divided by the number of hours' labor last year, gives, say, Mr. Shaw's 15 cents per hour to apply to this [illegible]r's expenses. If charges have been made [illegible]pose way, no special care being taken to [illegible]h job take its share of current ex[illegible] the foreman has slighted his duty [illegible]rged to "shop tools," etc., time which [illegible]ll make a job cost more than the estim[illegible] these things, and many others like them[illegible]crease the 15 cents, and lead to examin[illegible] This is the foreman's indicator diag[illegible] impartial, automatic, and truthful.

Mr. Shaw's paper has proved very interesting to me; notably for the strong endorsement he gives to the use of cards by men. The nearer we get down to hard pan, the nearer we come to the workman who does the work recorded, the more solid will be the structure we shall raise on his disinterested statements of the employment of his time.

The disadvantage of providing for more than one job on a card is its inflexibility. For example, in Mr. Shaw's Fig. 1, weekly time card, if a man works on more than 7 different jobs during the week, some will overlay and confuse each other. The remedy may be to make the card wider; but how much wider? And if made wide enough for all possible purposes, how about the paper, space, etc., wasted?

Then, I know from experience, that in transferring from cards to books, and in consolidating entries, there is a good deal of what I call "side-figuring" to be done; figuring which, if shown, would cover a good deal of paper. Now, all this can be avoided by making each card right for its own use, like printer's type, and using as many as we please, sorting and distributing them in as many different forms as we may please, sure that all accounts must balance, for nothing can be omitted.

The cards are equally adapted for "piece work" and for "machine work" by altering the rate to suit the case. This, especially for "machine work," should be done in the shop, under the supervision of the foreman, rather than later by a clerk who knows more or less of shop work, but who, however much he may know, can never be as nearly right as the man who put down what he knew at the very time he knew it.

R. GARDNER & SON.

MARCH, 25, 1885.

| NO. | NAME. | RATE. |
|---|---|---|
| 235. | Lannigan. | 0.25. |

| ORDER NO. | PIECE. | WORK. | HOURS. |
|---|---|---|---|
| 2147 | Spindles. or (S) | Lathe. or (L) | 2 |

## Modern Locomotive Construction.

BY J. G. A. MEYER.

NINETEENTH PAPER.

### LAYING OUT LOCOMOTIVE BOILER SHEETS.

It was my intention to contribute to the AMERICAN MACHINIST towards the end of this series of papers a few articles relating to laying out locomotive boiler sheets.

The inquiry "how to lay out these sheets," sent to you by one of your Western subscribers, and to which my attention has been drawn, and also inquiries relating to the same subject from a number of boiler makers with whom I have become acquainted, induce me to change the original arrangement, and consequently this and one or two other articles will treat on the above subject. After these, machine construction will be resumed.

In this paper we propose to explain the method employed in laying out the sheet marked *S*, Fig. 98. This sheet is called by locomotive boiler makers the "tapered course," and this name for this sheet we shall hereafter adopt. When we are engaged in laying out a sheet of this kind, we are simply solving a geometrical problem, and an easy one at that. How to solve such a problem according to geometrical principles is admirably shown by the illustration marked Fig. *A*, and which has been courteously sent to the AMERICAN MACHINIST by the Baldwin Locomotive Works, in which their method of laying out the tapered course is plainly given. Indeed, it is so plainly shown that any person with a knowledge of geometry can readily understand this illustration without any further explanation. Therefore, it simply remains for the writer to explain the geometrical principles connected with this subject, and show the practical application of these principles, which we shall endeavor to do with the simplest language possible.

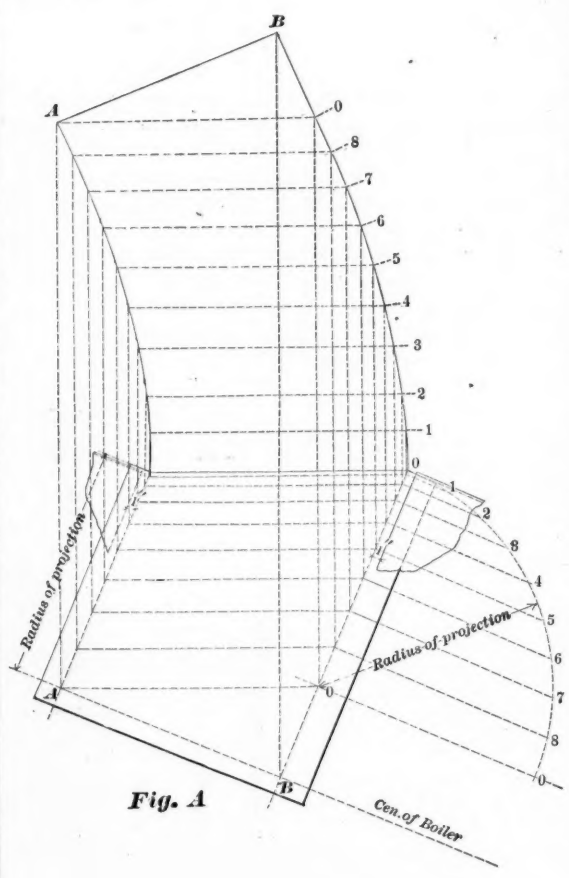



*Fig. A*

All good boiler shops are generally provided with blackboards, and on this the sheet is drawn which is to be developed or laid out. To do this the boiler maker must have a knowledge of some of the principles and rules connected with mechanical drawing. Here, then, the questions naturally arise, "What is drawing?" and "What are some of the principles and rules connected with mechanical drawing?" The term "drawing," in its widest and fullest acceptation, may be defined as the art of representing on a flat surface the boundaries of an object by the means of a combination of lines, thus producing a correct resemblance of the same, or, in other words, showing the object on a flat surface as it would *appear* to the eye. Hence, drawing, or the delineations of objects, may be called a written language employed to convey or communicate ideas of form. Drawing may be divided into two distinct classes:

1st. Free-hand drawing; that is, we may simply, with the aid of a pencil, and without any other instrument, draw the outline of an object as it appears to the eye, and thus give some idea of the shape or form of the same. This method of showing the form of an object is called "free-hand drawing."

2d. Mechanical drawing. Generally, a workman is not satisfied with a free-hand drawing, because it does not possess that accuracy which is necessary to show the true form of an object. Hence, for the purpose of making a drawing that shall possess sufficient accuracy, so that a workman can use it as a guide in shaping the material, we must call to our aid certain tools, commonly called "drawing instruments." Again, in the delineation of an object we must follow certain rules and principles, so that other persons can readily read the drawing, and our idea of form be correctly conveyed to them, without any explanation. The rules and principles alluded to are geometrical rules and principles. The delineation of an object accurately drawn, according to geometrical rules and principles, is generally called a "mechanical drawing." The writer believes that "practical drawing" is a better term for this class of drawing.

In mechanical drawings the *full lines* always represent the outline of an object which can be seen; *dotted lines* always represent that part of the outline of an object which is concealed. *Auxiliary lines*, or lines used to aid in the construction of a problem, are by some draftsmen dotted; in the illustrations connected with all these articles the auxiliary lines will be represented by dots and short, straight lines, such being adopted for the sake of distinction.

In order to show complete an object having three dimensions—namely, length, breadth and thickness—at least two views of the object are necessary. These two views must be drawn in line with each other; that is, if one elevation represents a side view and the other elevation an end view, one of these must not be drawn above or below the other view. Thus, for instance, the line *A B*, Fig. 96, p. 3, representing the bottom of the fire-box, and the line *C D*, Fig. 97, representing the same thing, must lie in the same straight horizontal line; and the same rule holds good for any other line or point representing the same thing in both views. Take, for instance, the line *E F*, Fig. 96, which represents the axis of the barrel of the boiler, and the point *G*, Fig. 97, which also represents the axis of the boiler (the axis in this view is seen endwise), both—that is, the point *G* and the line *E F*—must lie in the same straight horizontal line *X Y*, because these represent one and the same thing.

When a plan of the boiler, as shown in Fig. 100, is required, then it is best to place the plan directly underneath the elevation. Some draftsmen place the plan above the elevation, but in either case the plan should be placed in such a position that a line representing one thing in the plan, and a line representing the same thing in the elevation, both lines will lie in the same straight line. Thus, for instance, the line *M L*, Fig. 98, and the line *O N*, Fig. 100, represent the outer surface of the door sheet, and consequently these lines, if connected by a straight line *N M*, should form one straight line, or, in other words, the line *M L* and the line *O N* should lie in the same vertical line. Or, again, assume that the outer crown sheet and sides of the fire-box are made of one sheet of iron, then the line *I K*, Fig. 98, and the line *G H*, Fig. 100, represent one edge of this sheet, and since these two lines represent one and the same thing, the latter must lie in the same vertical line. True, sometimes for want of space on the paper, this rule is not always followed, but if we strictly adhere to the rules of geometry we must place the different views in the relative positions as just explained; particularly so when we are going to lay out a sheet the foregoing rule relating to the position of the different views should be strictly followed, because it will save a great amount of labor. And the same rule or rules which are applicable to drawing on paper are also applicable to drawing on a blackboard.

In order to lay out the tapered course *S*. Fig. 98, it is not necessary to show as much of the boiler as we have done in these illustrations, The aim in doing so, is simply to impress upon the reader the rule which governs the positions of the different views of an object on the paper or on the black board.

*Fig. 98*

*Fig. 99*

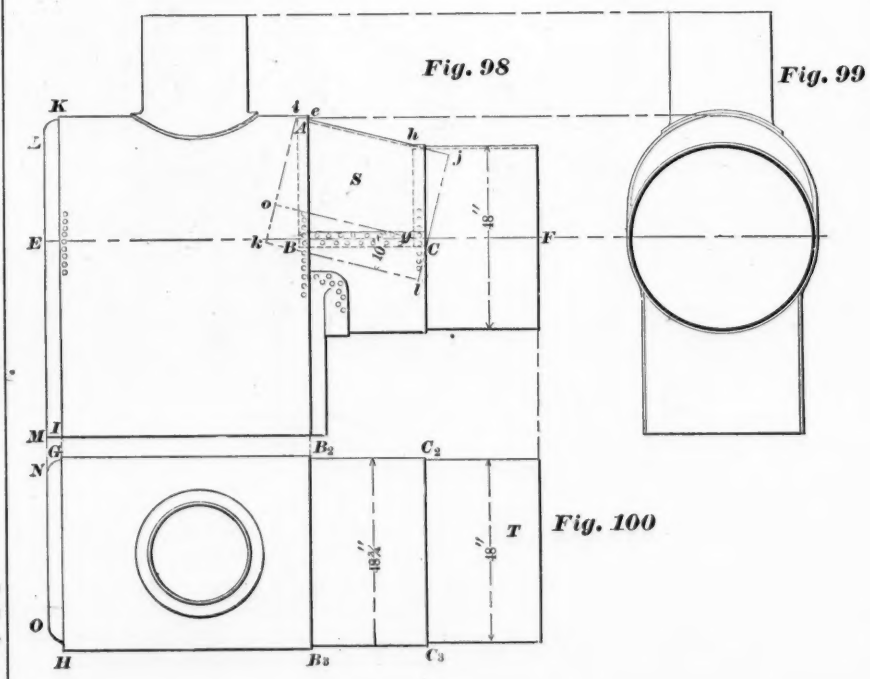



*Fig. 100*

Some locomotive boilers have no tapered course; in such boilers the fire-box and barrel are connected by a straight course marked *W*, Fig. 98. The shape of such a sheet before it is rolled is shown by the outline $B_1$ $B_2$ $C_1$ $C_2$, Fig. 103, and, as will be seen, the sheet is rectangular, that is, the long edge $B_1$ $B_2$ s parallel to $C_1$ $C_2$, and the short edge $B_1$ $C_1$ is parallel to $B_2$ $C_2$, and the short edges are perpendicular to the longer edges, or, in other words, the short edges are square to the longer edges. The length and breadth of the sheet can easily be determined without making a drawing of the sheet on a blackboard. Thus, for instance: In Fig. 96 we see that the distance from center to center of rivets is 31 inches; if to this we add the lap, then the total breadth of this sheet will be known. If the lap is $2\frac{1}{2}$ inches then the width of the sheet must be equal to $31'' + 2\frac{1}{2}'' = 33\frac{1}{2}$ inches, hence the distance between $B_1$ and $C_1$, Fig. 103, or the distance between $B_2$ and $C_2$ must be equal to $33\frac{1}{2}$ inches.

The length of the sheet is found in the following manner: In Fig. 96 we see that the outside diameter of the course of which this sheet *W* forms a part, is $48\frac{3}{4}$ inches. Now, assume that this course is made out of one sheet, and its thickness very small, say, for the sake of simplicity, $\frac{1}{32}$ of an inch thick, then the length of the sheet (before it is rolled), as shown in Fig. 103, will be equal to the circumferemce of a circle whose diameter is $48\frac{3}{4}$ inches, plus the lap. The circumference of a circle is found by multiplying its diameter by 3.1416, and therefore, in this case, length of sheet will be $48.75'' \times 3.1416 = 153.153$; to this the amount of lap must be added. But in locomotive boilers of this diameter the sheets are generally $\frac{3}{8}$ of an inch thick, and consequently when the outside diameter of a course is $48\frac{3}{4}$ inches, then the

inside diameter will be 48 inches. In rolling a sheet to its proper form the outside surface will be stretched, and therefore if we make the length of the sheet before it is rolled equal to the circumference of a circle whose diameter is $48\frac{3}{4}$ inches, our sheet will be too long. On the other hand, in rolling a sheet, its inner surface will be compressed, and therefore, if we make the length of the sheet equal to the circumference of a circle whose diameter is 48 inches, then the sheet will be too short. In practice it is generally assumed that in rolling a sheet, the metal in the center of its thickness will not be disturbed, that is, it will not be lengthened or shortened; consequently, the correct length of the sheet, for a course whose diameter is $48\frac{3}{4}$ inches, and its inside diameter 48 inches, must be made equal to the circumference of a circle whose diameter is $48\frac{3}{8}$, and to this length the amount of lap must be added. Thus $48.375 \times 3.1416 = 151.9749$, say 152 inches. Now, if the amount of lap is to be four inches, then the total length of the sheet to form the whole course will be $152'' + 4'' = 156$ inches. But the sheet $W$ forms only one half of the course, therefore its length from $B_1$ to $B_2$, Fig. 103, will be equal to

$$\frac{48.375 \times 3.1416}{2} + 4 = 80 \text{ inches.}$$

The shaded parts in Fig. 103 simply indicate the amount of lap.

The full lines $B_2$ $A$ $B_3$ and $C_2$ $D$ $C_3$ in Fig. 106 represent the shape of a sheet for a tapered course before the same has been rolled. Here we see the edges $B_2$ $B_3$ and $C_2$ $C_3$ are curved, to find these curves we must follow a construction in which auxiliary lines, such as marked 1, 2, 3 etc., are used. To make the explanation of this construction as plain as possible we will first refer to Fig. 103, and also Figs. 101, 102. In Fig. 103, as will be remembered, the sheet $W$, Fig. 96, is represented before the same has been rolled. Now suppose that on this sheet we draw any number of straight lines 1, 2, 3 etc., equal distance apart and parallel to the short edges $B_1$ $C_1$ or $B_2$ $C_2$, and that these lines are drawn in such a manner, so that they cannot be erased during the process of rolling the sheet. Now assume that this sheet with the lines drawn upon it has been rolled, then looking at the sheet sideways, the lines 1, 2, 3, etc., will appear to eye, as shown in Fig. 101, in this figure these lines are marked $1^a$, $2_a$, $3^a$, etc. Here the readers may ask, "How is it that before the sheet was rolled the lines were all equal distances apart, and in Fig. 101 no two of these lines are the same distance apart?" To this we answer that in Fig. 103 the lines are all seen on a flat surface, and in Fig. 101 they are seen on a curved surface. Indeed, in Fig. 101 we see only one half the number of lines which have been previously drawn on the sheet; the other half are on that part of the curved surface which we cannot see without going around the sheet and looking at it from an opposite direction. Here again the reader may ask: "How can we find the correct distance between the lines $1^a$, $2_a$, $3_a$, etc., shown in Fig. 101?"

Draw the outline of this sheet as it will appear to the eye, after the sheet is rolled, such as represented by $A$ $B$ $C$ $D$, Fig. 101. Also draw the end view of this sheet as shown in Fig. 102. In doing so Fig. 102 must be drawn in such a position so that $c_2$ and $c_3$, and $B$ $C$ in Fig. 101 (which represents the same edges) will all lie in the same straight line $X$ $Y$. The distance between the Fig. 101 and Fig. 102 is a matter of convenience and is of no importance. Notice that in Fig. 103 the distance between the lap, that is, the distance between $g_1$ and $g_2$ has been divided into fourteen equal parts; consequently in Fig. 102 we lay off from $c_2$ the amount of lap, say 4 inches, which will give the point $g_2$, also from $C_3$ lay off the same amount of lap, which will determine the position of the point $g_3$; divide the arc $g_2$ $h$ $g_3$ into 14 equal parts, and number each point so found as shown in figure. Each of these points represents, so to speak, the end of the line correspondingly marked in Fig. 103. Thus the points 1, 2, 3, etc., on the left hand side Fig. 102, will represent the lines 1, 2, 3, etc., on the left hand side Fig. 103, and the same remark applies to the lines on the right hand side of these figures. Through the points 1, 2, 3, etc., Fig. 102, draw straight lines parallel to $X$ $Y$, or, as the draftsman would say, square these points across. These lines drawn parallel to $X$ $Y$ are marked $1_a$, $2_a$, $3_a$, etc., in Fig. 101, and represent on a curved surface the lines 1, 2, 3, etc., drawn in Fig. 103, or in other words, the line $1_a$ in Fig. 101, and the line 1, in Fig. 103, represent one and the same line. And the same is true in regard to the other lines.

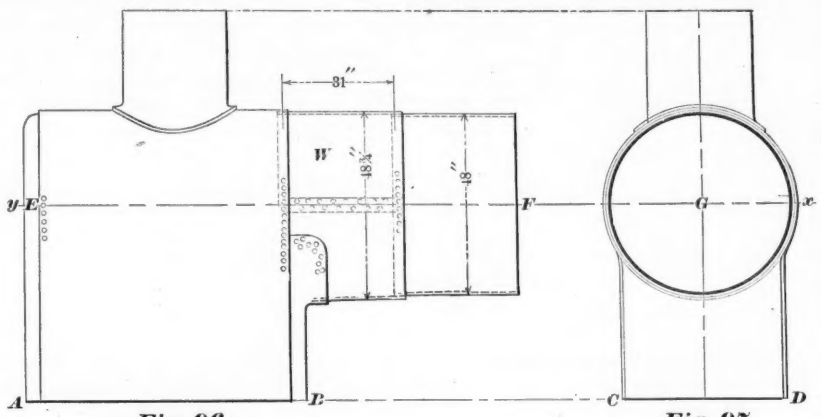



Fig. 96 Fig. 97

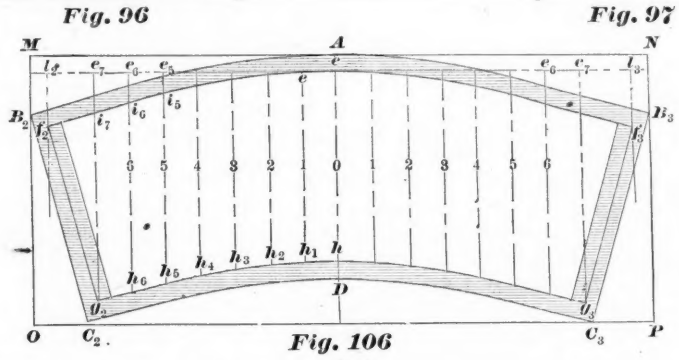



Fig. 106

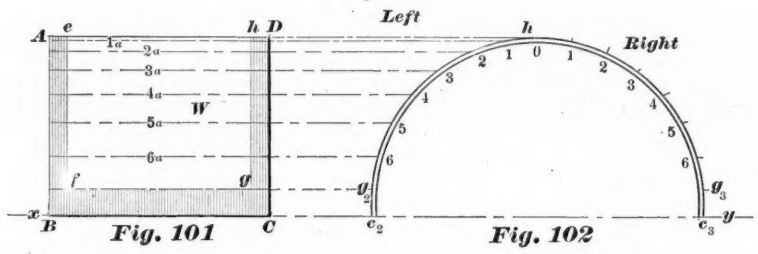



Fig. 101 Fig. 102

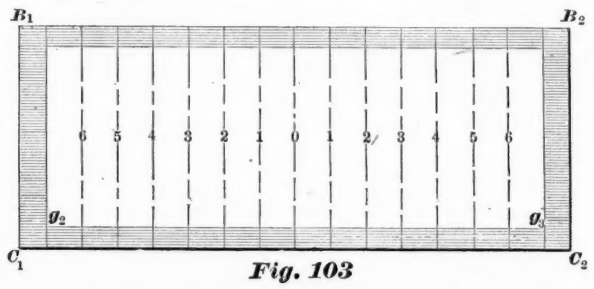
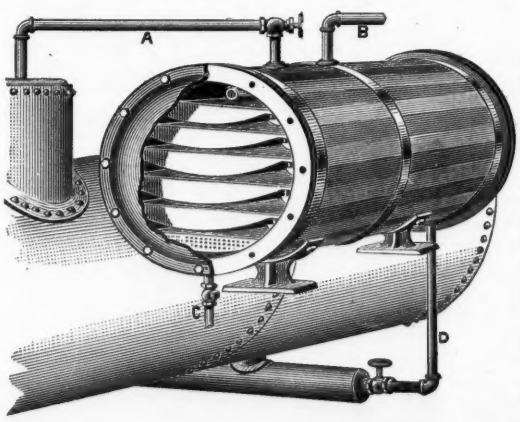


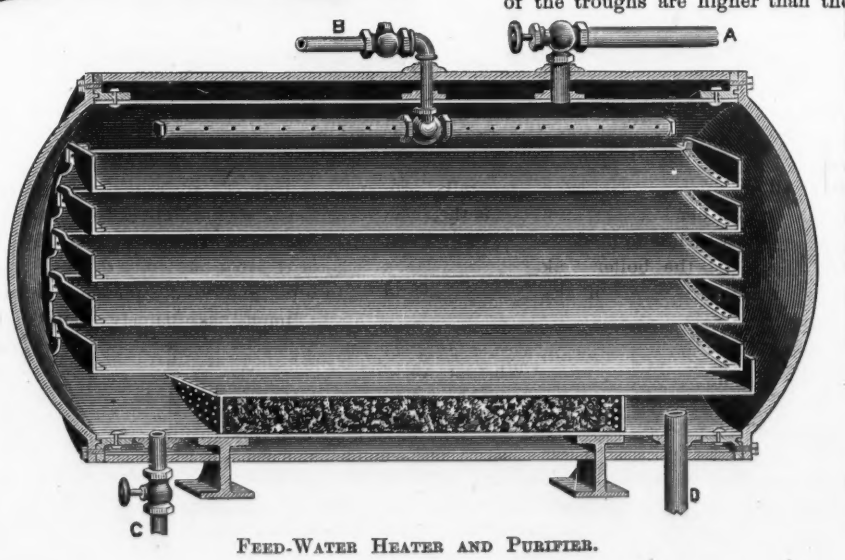

Fig. 103

We will again draw attention to the fact that the two views, viz.: Fig. 101 and Fig. 102, must be drawn on the same straight line $X$ $Y$, if not it will be impossible to square points across from one view to another; and, therefore, to determine the position of the lines $1_a$, $2_a$, $3_a$, etc., in Fig. 101 with as little labor as possible, these two views must be drawn as shown.

## Feed-Water Heater and Purifier.

The accompanying cuts show a feed-water heater adapted to removing solids and impurities from the feed-water before entering the boiler, by a somewhat novel process. The heater consists of a strong boiler-iron shell, with a heavy cast ring riveted to each end, to which the heads are fastened by studs and nuts. Within the shell are a number of trough-shaped trays or pans, placed one above the other, which are supported on longitudinal ways or rods fixed by means of brackets to the sides of the shell. The end pieces of the troughs are higher than the sides, and have projections at each extremity to rest on the ways on which the troughs are adapted to slide. These troughs are formed from thin sheet steel, the heads or end pieces being made of malleable iron, whereby a light and strong construction is obtained, and at the same time a degree of elasticity or resilience secured to the trough, which permits the lime or other incrustation being readily and easily removed.




Feed-Water Heater and Purifier.

Below the troughs is placed a removable steel plate, the edges of which are turned up on each side, and provided with an end piece or head at the rear end. Under this plate is fixed two perforated plates (as shown in cut), between which is placed crushed coke, charcoal or other suitable filtering material.

A blow-off pipe $C$ leads from the front chamber, and an exit pipe connects the rear chamber to the boiler. Steam is supplied to the heater from the boiler by a large steam pipe $A$.

The heater should be so placed that the end of pipe $D$, inside the heater, is at least 18″ above the water level of the boiler, and, as the same steam pressure is maintained in the heater as in the boiler, the water flows from the heater by gravity, and never rises above the plate in the bottom.

The operation of the heater is as follows: The water is pumped into the heater through pipe $B$, and is distributed in the upper trough by the perforated pipe in the top. When the trough is full, the water flows over the sides, and, following the outer surface of the bottom, flows in a thin uniform sheet under the bottom until it reaches the center, when it drops into the trough below, and so on over each successive trough until it reaches the plate at bottom, over which it passes to the chamber at the front end. From the front chamber it passes through the filter to the rear chamber, from which it escapes to the boiler through pipe $D$.

The water flowing in a thin, uniform sheet under the bottoms of the troughs, and subjected to the direct action of the steam, is heated to the boiler temperature, and will part with the scale-making properties it contains, the greater part of which will adhere to the *under sides* of the troughs.

During the operation of the heater the troughs remain filled with water, and some of the solids settle inside of them, but the amount thus retained seldom equals one-fourth part of the scale found on their *under sides*—a fact which is held to demonstrate the superiority of the *under-side* lime-catching surface.

When the heater is ready to cle an, which is usually after from 30 to 60 days' run, from 1″ to 2″ of scale will be found on the under side of the two upper troughs, from $\frac{1}{2}$″ to $\frac{3}{4}$″ on the third, $\frac{1}{32}$″ to $\frac{1}{8}$″ on the fourth, and about $\frac{1}{64}$″ on the underside of the fifth, or lower trough. As the filter seldom showed any trace of lime it has been dispensed with, and the capacity of the heater increased by an addition trough below.

Scale taken from the under side of the top trough is usually soft, but that from each succeeding trough is harder and thinner than the one above, that from the two lower troughs being very hard and almost transparent.

The extreme thinness and sometimes entire absence of scale on the under side of the lower trough makes it evident that water in passing through this heater is made practically pure, and cannot cause scale in the boiler.

To clean the heater, first close the boiler connections and cool down by pouring in cold water and blowing off. The sudden change of temperature will cause most of the scale to burst off the under sides of the troughs, leaving very little to remove by hand. One head is then removed and the troughs drawn out, and the remaining scale jarred off by dropping the pans on a solid floor, or scraping, after which they should be washed or swept clean. Should a filter be used it should be renewed, if necessary, before replacing the troughs.

As the water in passing through this heater is heated to the boiler temperature before entering the boiler, all shocks and strains incident to feeding water at a lower temperature are thus avoided, and ruptures and explosions rendered less liable. The manufacturer of this heater, John J. Hoppes, Springfield, Ohio, guarantees that it will purify any feed water so as to prevent scale in the boiler.

## Pattern-making.

BY F. W. BARROWS.

NINTH PAPER.

SPIRAL GEARS.

I see that I should have carried my explanation of the templet described in AMERICAN MACHINIST of January 30, 1886, further, and shown why I would go to the trouble of making a templet which would be absolutely correct only at one point, viz.: the pitch line.

The templet shown was for a V gear; as a V could be made of two spiral wheels, one right and the other left hand, it follows that the templet would do for a spiral gear of the same dimensions.

I do not think Mr. Ehrmann appreciates how much, or rather how little, the templet described in January 30 would vary above and below the pitch line. If he will make two drawings similar to the one shown by him in AMERICAN MACHINIST of March 6, 1886, one of a circle at the pitch line, the other at points of teeth, and one of them on tracing paper, then lay the one on tracing paper over the other and turn it round until the ends of the spiral line on each drawing coincide, he will see at a glance how much my templet would vary from the true line at point of tooth if made for his pinion.

If he will also carefully look over my article, in issue of January 30, he will see that the templet described by me, and the one he uses to transfer the teeth from one side of the wheel to the other, are one and the same; consequently the only difference between his method and mine is in the additional templet which he makes to true up the teeth from the line drawn across the points.

Unless the wheel has a very wide face in proportion to the pitch, I consider my way of working the teeth much quicker and quite as accurate. In case the wheel or pinion is of wide face and fine pitch, I should put the teeth on with dowels and screws that I might remove all but the tooth I was working. This would be impossible by the method he describes, and I think there would be some difficulty experienced in finding and using a tool or tools which would go between the teeth of a spiral pinion of 3″ face and about ⅞″ pitch, which gives a space of less than ½″.

A much better way to make a small cast pinion like this would be to cast a blank and have it cut on a milling machine as described by O. J. Beale, in the AMERICAN MACHINIST of September 12, 1885. I think a cut gear pattern for any kind of a small wheel (I have made blanks for this purpose up to 36″ diameter) much superior to a wood pattern, for reason that the spacing is or should be accurate. This, as I have stated before, I consider of the first importance, and it is a very difficult job, and one not often accomplished, to so space, lay out and work a gear pattern that it will stand the test of a pair of calipers or a gauge.

I don't like to work gears from the top of tooth, especially if the shape of flank makes it necessary to use a gouge, because you must get the tooth right for the whole depth before any part of it is right. Consequently you must cut a little off the face of tooth with a chisel, then lay down your chisel and use a gouge to cut off the flank and, perhaps, use still another gouge if there is a fillet at root of tooth; then try your templet and go through the same operation again, and then repeat as many times as necessary. See how much easier and quicker we could work the same tooth from the outline on each side. Find a gouge that will fit the fillet at root of tooth, and cut all across the tooth until the templet shows that the top edge of fillet is right; the rim of wheel will of course govern the lower edge. This completes the fillet at one operation and also gives the direction of lower portion of flank. Now work the flank right down to the lines, leaving the face of tooth until last. I think two or three teeth could be worked in this way while one was being worked from the top.

For a worm wheel perhaps the merits of the two methods would be about evenly divided, owing to the extra crook made necessary to fit worm.

As I have already said so much let me add a little more and tell how to lay out a spiral line.

For the sake of simplicity the line required is to be one the circumference of a cylinder 3.82″ diameter, 24″ spiral pitch and 2″ long. Draw a line on surface of cylinder parallel with axis as line *a b*, Fig. 21. Then space

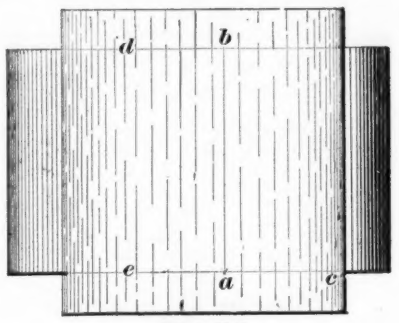



*Fig. 21*

PATTERN MAKING.

off one inch at one end of cylinder, as from *a* to *c*, this is the advance of spiral in 2″ length of axis. Now take a piece of card board, or if a permanent templet is required use a piece of tin or thin brass. Lay it smoothly and tightly on the surface of cylinder as shown in figure, and with a sharp point mark along each end of cylinder, and mark also the points *b* and *c*. Then lay the card board or sheet metal down flat and draw a straight line through the points *b* and *c*. This line, when the cardboard is held on the surface of the cylinder, is the same as the spiral shown by Mr. Ehrmann, and has these advantages: It is much easier to make and has no angles, but is theoretically and practically a true spiral line. This templet will do for a right or left spiral by turning one or the other side down as may be desired.

To make it convenient to use fasten on two strips outside of lines *d* and *e;* this keeps the shape and serves to square the templet with cylinder.

I shall describe laying out and working screw threads made both with and without cores, in some future paper.

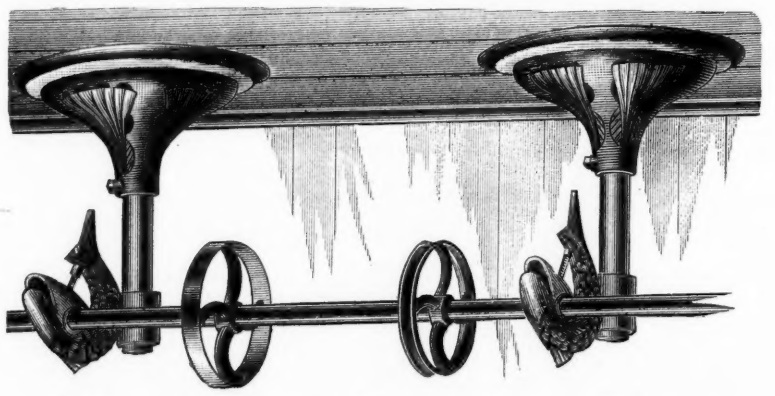
## A Steam Fishing Schooner.

The fishing steamer Novelty, says the *Industrial Journal*, has lately been fitting out at Gloucester, Mass., and was to sail this week for the southern mackerel grounds. The Novelty was built at Kennebunkport, Maine, last year, is 291.50 tons gross and 197.46 net register, with engines of 300 nominal horse-power. She carries fifty-two men, four seines, three seine boats, and will be fitted with a steam seine boat built in Gloucester. The seine will be pursed by steam. All the appliances are modern, some of them the first of the kind ever used on a New England mackerel fisherman.

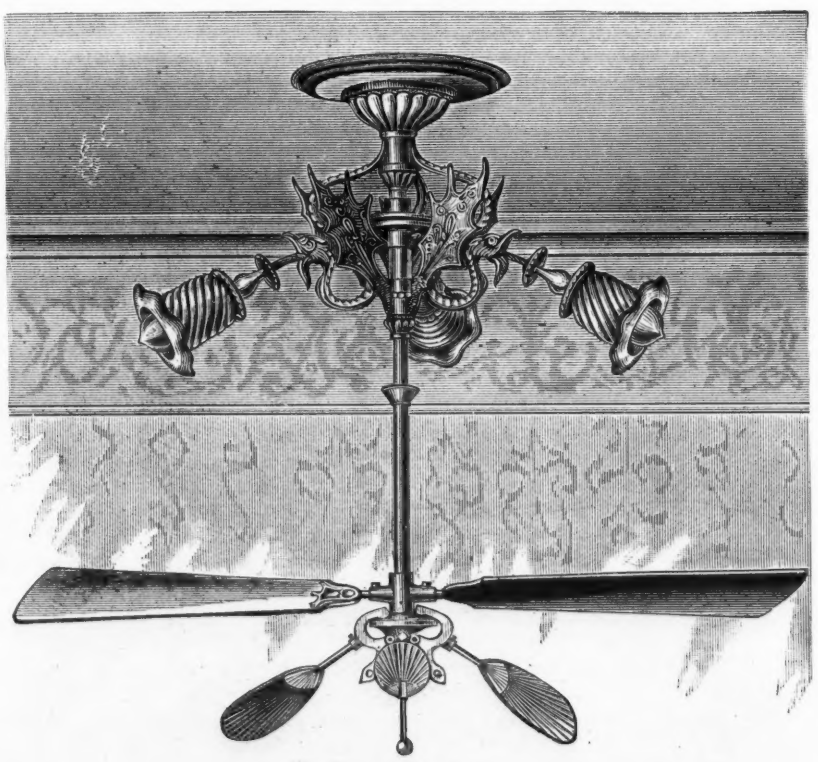
A genius from the "wooden nutmeg" State has invented a clock in which there is a money-drawer. Money can be deposited at any time, but can only be removed during one day in a month. Another notion is in screwing the clock to its shelf, so that it can only be removed when the drawer is open. These clocks should be adopted by the impecunious, who can't keep their loose change in their pockets.

## Arrangements of Circulating Fans.

The use of circulating fans for workshops, as well as for other rooms where people congregate, has become almost universal, and the manufacture of artistic fittings for such purposes has become a business. With this, we show two of these arrangements, as made by the Backus Water Motor Company, Newark, N. J.



HANGER.



ELECTROLIER FAN.

The electrolier fan has a hanger composed of three parts, fastened at the bearing by interlapping rings, which are put around the shaft. Babbitt being poured, fastens the whole together, and at the same time forms the bearing for the shaft. The hanger is fastened to the wall by spider and single lag screw through the center, leaving no bolts or screws in sight. It is very easily put up.

The hub carrying the fan blades is loose from the shaft, and is controlled by a friction operated by the small fan hanging below. The speed of the blades can be regulated by this small lower fan, fast or slow, as desired.

In the hanger shown, the shaft is carried through the eye of what is intended to represent a fish. The top of the head is loose, and held in place by the set-screw shown bearing against the tail. The oil is poured into the mouth, and fed by the tongue through the throat. The overflow passes back into the reservoir through small apertures in the gills. These hangers can be adjusted to suit any length of fan hanger.

## Learning to Draw.

BY JAMES F. HOBART.

ACCURATE WORK WITH AND WITHOUT FINE TOOLS—BISECTING ANGLES—CONSTRUCTING A PROTRACTOR—LINES AND POINTS—CONSTRUCTING A SQUARE—CLEAN WORK AND DIRTY WORK.

In the last paper two or three methods were given of erecting perpendiculars, and the student doubtless remarked: "I can do that twice as quick with a square," and so he can. He can erect a line, but it is not known to be correct. The square may be untrue, or he may not lay the edge of the square exactly parallel with the given line, and the result will be what poor workmen call "good enough."

For ordinary work, perpendiculars are correctly erected by means of T square and triangle, but it is the student's business to be able to obtain results without the use of these tools.

Almost anybody can do a good job when he is supplied with perfected, almost automatic tools, but to be a good draftsman is the same as to be a good machinist; the student must learn to do the work with a few primative tools and his brains. By so doing, the brain is enabled to add perfection to success when the elaborate tools are finally placed in hand.

Bisecting lines and angles will form a desirable study for our class. Erect a perpendicular on a line, and we have bisected an angle of 180 degrees; that is, we have cut the angle into two angles of 90 degrees each.

If we now take as a center the intersection of the horizontal and perpendicular lines and describe a semi-circle cutting these lines, we have a semi-circle divided into two arcs of 90 degrees each. If we bisect each part again, we obtain four 45-degree arcs. At this point, if we place one leg of the compasses upon the point where circumference and perpendicular meet, and cut the circumference on either side of the perpendicular, if we do the same from where circumference and horizontal line meet, we obtain spaces of 15 and 30 degrees, and when they are still further sub-divided, an arc of one degree may be obtained.

The result of this work is virtually a protractor, from which any angle may be laid off or measured. This method is another example similar to that of erecting perpendiculars; we should not use it when we could obtain a good protractor or scale of chords, but we want the "know how" of it, that we will not be dependent upon tools.

When drawing the above, and all other geometrical figures, make the lines just as light as possible.

The definition of a point is: "Something which has neither length, breadth or thickness;" or, in other words, has "position, without magnitude." When we talk of a line, we mean something produced by the movement of a point, or "that which has length without either breadth or thickness." Such being the definition of a point and a line, let us bear the fact well in mind when producing these useful marks on our drafting board.

If we make a mark on paper, and call it a line when a surveying party is needed to locate its center, then we may not call ourselves draftsmen during this term of our school.

The same remarks apply to a point. The student who gets his would-be "points" all mixed up with "fly spots" on the paper

had much better take a vacation from the drawing room and go to locating post holes on a western ranch.

When drawing a figure, we must keep the pencil very sharp, make light lines and produce them further than the points of intersection. Let us draw a simple square: Draw a line on the paper considerably longer than the desired length of a side of the square. Erect a perpendicular upon this line, then with the length of a side as radius, cut the base and perpendicular, and with these two points as centers, locate the remaining corner of the square. Next, draw the two remaining sides, and produce the lines, in pencil, far beyond the point of intersection with adjacent sides. The use of this will be apparent when the drawing is to be "inked in."

If we had drawn sides of the squares only to the corners, we should have had nothing to serve as a guide for stopping the pen, when "inking in." By producing the lines in the above manner, we can see just where to stop, as well as where to begin the ink, and it also assists greatly in placing the straight edge exactly parallel with the line to be drawn in ink.

Another point also requires a great deal of attention: Make the drawing clean, and keep it clean. A lot of thumb marks, grease spots and marks from pencil clippings don't improve the appearance of a drawing, and when the attempt is made to put on the ink then the presence of dirt will make itself known without ceremony.

India ink will *not* work well over dirt or grease, and any attempts to make it do so will prove a poor job. It may seem a little hard after working all day in iron filings and grease, to be expected to come to the drawing board with fingers which will not spot paper, but there is no trouble in doing so. Wash the hands clean, and take care that the nails are clean also. Sufficient dirt to spoil twenty drawings can lodge under a single finger nail, and the man who is a good draftsman never comes to the board in that condition.

Never rest the arm or elbow on a drawing board, if you wish a clean drawing. Never pass the hand over the face, or any part of the head; the hair especially will grease the fingers sufficiently to make a dirty drawing,

It may look a little hard to lay down so many "rules and regulations," but as "eternal vigilance is the price of liberty," so complete cleanliness is the only method of getting a nice drawing. Of course a drawing may be cleaned; sponge, rubber, or stale bread will take off part of the dirt, but we might as well drive a board full of nails and try to pull out the marks when we do the nails, as to try to make a good looking drawing while we have on our overalls and jacket fresh from the shop.

## A Draftsman's Fatal Defect.

"One of the queerest cases I ever heard of," said the story-teller in the smoking car, "is down in our town. There's a man there who has a peculiar defect. I know him well. He's a draftsman, and an accomplished man. He can draw anything he is asked to draw, with a solitary exception, and do as good a job of it as any man in the country. But that one exception lost him his situation, his wife, his friends and his reputation, and now it is killing him. Isn't it strange?" "Very. But what is that he can't draw?"

"A sober breath."—*Chicago Herald.*

Don't try to use a belt which slips. Also, don't daub on a lot of resin, soap or tar. Take up the belt, and do the job right.

Some jobs come into a machine shop, which are "necessary evils." The man who brings a $1.50 revolver and wishes you to spend two hours of time in making him a spring for 25 cents, is not a desirable visitor, but the job is done with the hope that he will bring a big job "sometime."

Don't do it. When a chap comes with an old shot gun for a new main-spring or brings in a toy engine to be "tinkered," just charge him so much that he never will bring another job like it. It will pay in the end.

## Core Oven.

By Robert E. Masters.

I am indebted to Harry F. Bayley, of Wm. Bayley & Co's. Foundry and Architectural Iron and Wire Works, Milwaukee, Wis., for sketches of a core oven, which to me is a new and novel idea, and, I think, a decided improvement on the old style of core ovens.

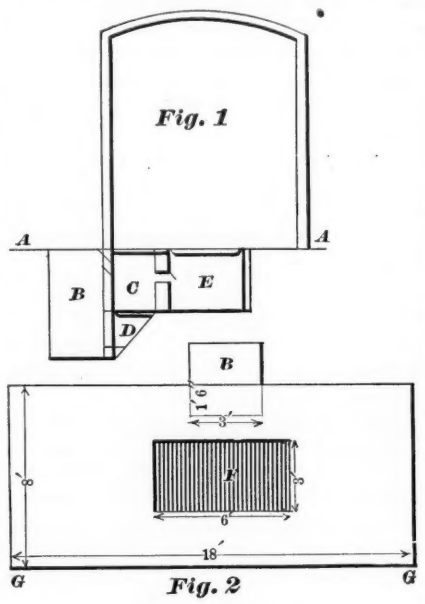


*Fig. 1*

*Fig. 2*

Core Onen.

In the ordinary plan, the fire-place is built either in one corner or at one side of the core oven, with the grate-bars on a level with the floor or elevated above it. And in putting the cores in the oven to dry, a great deal of care has been exercised in placing large and small cores in the same oven, so that the large ones will get thoroughly dry and yet not burn the small ones.

I have seen core ovens so arranged that a great space had to be left vacant around the fire place, to keep the flames from coming in contact with the cores, as the outside would get burned before the core would be dried through. I have noticed this more especially where they use wood altogether to dry their cores.

In section view Fig. 1, *A A* is the floor line; *B B*, Fig. 1. and plan, Fig. 2, is a pit for a person to get in to arrange the fire in the fire-place *C* and remove the ashes from the pit *D*. The top of the fire-place *C* is covered with a heavy cast-iron plate the heat making its way into the oven from the heat pit *E*, between the grate-bars, as seen at *F* in plan Fig. 2.

An arrangement of this kind would, I believe, give a much more even distribution of heat than ovens built on the old plan. Shelves could be arranged on both sides, and at the back end of the oven for small cores which would not interfere with any work that is run in on a carriage.

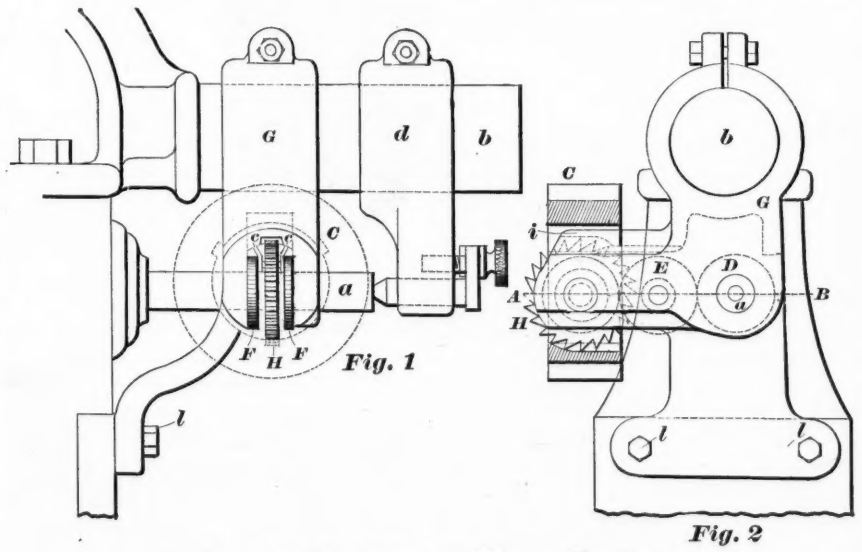
I have no details as to what provision was made for the escape of the smoke, but the best plan would be to build two small flues at *G G*, with an opening into them a few inches above the level of the floor.

## Internal Key-seating on Milling Machines.

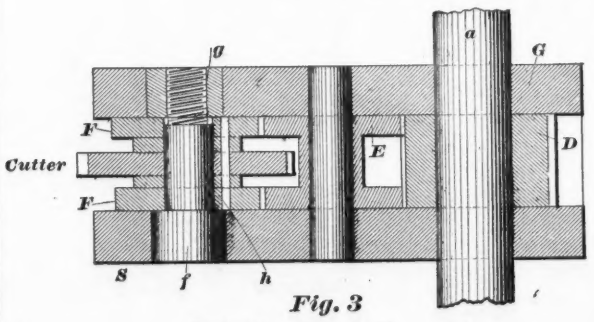
By A. B. Landis.

Much time and expense can be saved, and better work done, by key-seating holes by the use of a milling cutter, especially in doing a number of special pieces an item of expense is saved. The milling machine, as constructed, is not adapted for doing this sort of work without some special attachments, and the amount of work of a kind to be done and the accuracy required should be the basis upon which the mechanic should decide whether or not it pays to make such an attachment for the special work.

I send you herewith, drawings showing a device I made to attach to the regular over hanging supporting-arm milling machine. I made this attachment for a special piece of work of which a number of pieces are made, and in which accuracy is required. It was a pinion *C*, Figs. 1 and 2, which, owing to its small outside diameter and its comparatively large hole, makes the metal rather light; consequently it was not safe to put one large key in it (as it has heavy duty to perform). I therefore adopt the plan of three small keys, and by mounting the pinion *C* on a suitable chucking plate, on an index head of the machine, I can make three key-seats of equal




Internal Key Seating on Milling Machines.




Section on Line A B.

division, so that they will perfectly match key-seats that are cut in the shaft in the same manner. Now, by having the pinion a close fit to the shaft, and these keys fit tight on the edges only, where they will now fit perfectly, this light metal pinion has no bursting strains on it, and is sure not to get loose. With such a key-seating device, an accurate depth can also be obtained in these pieces, as well as in milling keyways into a shaft; therefore, keys for the same work can all be make to a size, and can be made interchangeable, which is also a good point.

In the drawings, Fig. 1 shows an elevation of the miller supporting arm *b*, its center-head *d*, and the attachment, composed of one casting *G*. Fig. 2 shows an end view of the same, with the center-head *d* removed. The casting *G* is bored to fit the arm *b*, and is clamped to it at the top. A hole is bored the correct distance to fit the arbor *a*, which runs through the casting and is supported outside in addition by center of head *d*, and is secured to the body of the machine by bolts *e e*. On arbor *a* a pinion *D* is secured which meshes into pinion *E*, which in turn meshes into pinions *F F*, located on each side of the milling cutter *H*, and have a boss on one side of them to keep the toothed parts away from the cutter. The small arbor *f*, carries this cutter and the pinion; it has large-sized bearings, which form a shoulder to clamp the cutter and gearing together, which is done by nut *g;* this also forms the other bearing *a;* pin *h* through the cutter and pinion, prevents any slip. The nut *g* has a slot on its edge, and is fastened by a forked screw-driver. The cutter and pinions combined, make a neat fit on the inside surface of the casting *G*, which is smoothly planed. It will be apparent that the cutter *H*, pinions *F F* and arbor *f* must be put together in the casting. Hardened steel bushings inserted for the bearing of arbor *f* would be of great advantage.

Pinion *E* is cut out in the center to escape the cutter *H; c c* is a guard to prevent any cuttings from falling into the gearing that may be carried up by the milling cutters. This attachment can be used for other internal work, such as interval gearing or fluting. It can also be made to cut into a long hole by extending the arm *i* and adding intermediate pinion, and, if too long to insure sufficient stiffness, could have a guide on each side and one on top, either made of hardened steel or in the shape of a small roller, and use the wall of the hole as the support, in which case a very long hole could thus be slotted or key-wayed.

The key-seating of holes by a milling cutter may not be new, yet it is new to me, having never seen anything of the kind before, and, thinking there may be others to whom this may be of benefit, I contribute the same to the columns of the American Machinist.

## LETTERS FROM PRACTICAL MEN.

### Sweeping Square Corners—Making Weights.

*Editor American Machinist:*

In my experience I have swept a good many green sand castings. The following plan for working up square corners may be new to some of your readers. I have found it to be good. You wish, for instance, to make a wheel. Fix your sweep and sweep up hard all around where the rim is to be. Work it off as square as you can without much trouble or time, then take hold of the sweep with one hand, the cutting edge towards you, and with the other hand pick some of the sand swept off, and throw it on the corner. Work it rather hard at first, then bring the sweep around five or six inches, and back again, and throw on more sand. Keep on doing this till you bring up a square corner. This is better and cheaper than going to the pattern maker and getting segments made for every corner.

When I want to make a weight exact, as, for instance, a door weight, I ram it up without a top, put the staple in the bottom, set it on the scales, add what weight is desired, and pour till the beam rises.

Thomas Wathey.

Cleveland, Ohio.

### Steam Heating vs. Furnace Heating

*Editor American Machinist:*

Mr. Beckett, in your issue of April 10 gives laymen some excellent hints on furnace heating, but his experience is not that of the majority of those who have used both systems. Undoubtedly he has a model arrangement. Of the economy as between steam and furnace heating, I have never seen but one result, viz.: the steam heat costs materially less for fuel, I have in mind, at this writing, three examples of the substitution of steam for furnace heat in private houses, and in either the saving was not less than 33 per cent. Furthermore in each instance the parties for whom the substitution was made greatly preferred the steam heat, and firmly believed, as evidenced by the difference in shrinkage of furniture and surroundings, that the air was moister when heating by steam.

As for ventilation, it goes without saying that no system of heating—furnace, steam or stove—will be satisfactory unless that is provided for. But it has not yet been shown that proper ventilation is peculiar to either system.

To the statement that "it is a notorious fact that air heated by steam pipes is the dryest and most unpleasant to endure of that obtained by any system of heating," I take decided exceptions. If heat is imparted in the same degree, and with the same rapidity, the ventilation being the same, there will be no difference in this respect except this: It is a well-known fact that no boiler, steam pipes or other iron enclosure can absolutely prevent the escape of steam. However tight to the senses a boiler may be, if fired up till steam is raised, then allowed to cool to the same temperature as before firing, there will be less water in it than at the beginning. This has been practically and scientifically demonstrated until it is beyond dispute. It shows that vapor must escape through the metal, or that joints cannot be made so tight as to entirely restrain the vapor. This points to the conclusion that a little moisture will escape through radiators and pipes, and to that extent increase the humidity of the air.

Frank Gleason.

### Tests of Iron.

*Editor American Machinist:*

R. E. Masters' article on the strength of iron, in your issue of March 27th, is a good one and of value to foundry men. I have also records of a number of tests made in Boston in 1880. As they may be a benefit to foundrymen, I will give them for the benefit of the trade. You will see by the scale that my test pieces were cast at the different parts of the cast. Those marked No. 1 were taken from the first of the cast, No. 2 at the middle of the cast and No 3 at the last end of the heat. The iron marked "Returns" was bad castings and gates.

The cupola was charged in charges of 1000 lbs. at a charge. The length of test bar was two feet, one inch square, and tested on the same plan as Mr. Masters' was.

FIRST DAY.

| | | | TEST. |
|---|---|---|---|
| 300 lbs. | No. 2 X Crane | No. 1= | 1,117 lbs. |
| 200 " | " 1 Pomeroy | " 2= | 1,270 " |
| 200 " | " 1 Coltness | " 3= | 1,280 " |
| 200 " | Returns. | | |

SECOND DAY.

| | | | |
|---|---|---|---|
| 300 lbs. | No. 2 X Crane | No. 1= | 1,225 " |
| 200 " | " 1 Pomeroy | " 2= | 1,271 " |
| 200 " | " 1 Eglinton | " 3= | 1,283 " |
| 300 " | Returns. | | |

THIRD DAY.

| | | | |
|---|---|---|---|
| 300 lbs. | No. 2 X Crane | No. 1= | 1,167 " |
| 200 " | " 1 S. Easton | " 2= | 1,364 " |
| 200 " | " 1 Eglinton | " 3= | 1,346 " |
| 300 " | Returns. | | |

Daniel Spence, Foreman.

G. W. Brown & Co.

Galesburg, Ill.

### Making Wooden Emery Wheels.

*Editor American Machinist:*

I read in the American Machinist of April 3d, an article on wooden emery wheels. Mr. Hobart is quite correct as far as he goes. A few years ago I made about one dozen of the wheels in question, and my experience teaches that the following method is the most substantial for long wearing: I took the best white pine I could get, $\frac{3}{4}$" thick when finished, cut out the half circle of wheel; then I applied glue and laid the half circles so that the grain of wood and joints of pieces of wood came in opposite directions; when the wheel was all glued and laid together (it was 3" thick and about 18" diameter), I put on enough clamps to have a good strain on the glue, and then I would drive in a few nails to aid in securing a good job. When the glue is set solid, bore the center hole for bushing, which was made with a flange on one side, and that was screwed fast to the wood; the bushing should project through the wheel, coming just flush with the wood. The wheel was then put on an arbor, a loose collar and nut made it solid against a tight collar on the arbor; I then turned the wheel off, all over; then I would have my glue hot and handy and apply it to the leather on the unfinished side, only taking about 6" at once, for as quick as the glue was on there, I would fasten it down solid with wooden pegs, such as shoemakers use; I put four rows in the leather, about $\frac{3}{8}$" apart, taking care to get them in while the glue is hot. This is all done while the wheel is on the arbor in the lathe. After the glue was set I coated the wheel with shellac varnish, keeping from the leather. It is well to have a square trough to put the emery in, so that when rolling the wheel none of the emery is lost by scattering on the floor.

These wheels are doing good work, and the hardest kind; polishing bolt heads and nuts where sharp edges are liable to catch.

Tom Dover.

### Under and Overbidding.

*Editor American Machinist:*

In your article of April 3d, 1886, "Under and Overbidding," you note a great difference in price for a boiler of 100 horse-power, to be built from same specifications. I have noted as great differences in bids in other lines of manufactures.

This may come from bidding by what may be termed *business pirates*. They may not mean to be, but, if they bid too low from not knowing how to manage their business, or do not care as long as they can borrow money or sell their bonds to run with, the result is the same. They cut prices below what a manufacturer should have who pays his debts, and finally go into the hands of a receiver, and the honest manufacturer has in the end to pay these losses. This is notably the case of the way in which one or two works I know of have been managed, and with the result as above stated. X.

### About Studying.

*Editor American Machinist:*

In your issue, January 16, I noticed a very interesting letter from J. J. Bingley. This letter is full of excellent suggestions and useful advice to young men. The following sentence may be taken as a sample: "If a young man wants to make his mark he must study; work out the problems of science or mechanics."

No one can doubt the wisdom of this remark, but few persons know how difficult it is for a young man to settle down to this kind of work.

In the first place he may not have a reading habit, or a studying mode, or an observing mind; he cares nothing for science or mechanics. The pleasures of life are too alluring; to have present happiness seems much more profitable than to work for some future uncertain reward. I know how it is myself. I have worked in some of the best shops, and in large cities where every opportunity was offered to learn these things, but I never thought of it then. It was only by chance that I took up this study, and although I have not made any progress to speak of, I have thought the books that I have found useful to me may be so to others that are beginning to learn. But I am not sure that they are the best; I think it would be of general interest if some of your readers would give some of their experience and progress in this study, and the names of the books that are suitable to beginners of limited education as well as some instruction on study.

The following is a list of the books referred to: Wells' Natural Philosophy. (I think it most important that a young man in our business should first learn something of those physical laws and theories which seem to be the ground work of our trade.)

Watson's Modern Practice of American Machinists and Engineers; the Complete Practical Machinist, and Slide Valve Practically Explained by Rose; Haswell's Engineers' Handbook, Roper's Engineers' Hand-book; also Questions and Answers for Engineers, by the same author; Edwards' Catechism of the Marine Steam Engine; Growth of the Steam Engine, by Thurston; Energy and Motion, a text book of Elementary Mechanics, by William Paice.

I got these books one at a time, and read them slowly, so as to thoroughly understand them. Some of them I read over and over again, and work out most of the examples. I also take the American Machinist, from which I get more information than I do from the books. I often see in a single copy, information that is of more value to me than the subscription amounts to in a year. I read carefully, and anything that I don't clearly understand, I write out. (Anyone who has not tried this method will be surprised to find how easily he can comprehend difficult subjects.) I also make drawings of all those things that are likely to be useful to me, and try to study out the problems.

From these books and the paper I have learned many things. For instance, if one wanted a steam engine of a certain size I could give size of cylinder, and size of proportion of all its parts; also size, thickness and strength of boiler to supply steam for same, besides having a good idea of its best care and management, knowledge which has been of incalculable use to me.

Study is now my recreation, and I find greater delight in my books than I ever did in other ways, and if my progress would only equal my desire to learn, I should be most happy.

A great many men think any machinist will make a good engineer. This some of them may find to be a mistake unless they constantly study everything that pertains to their trade, and engineering I call a part of it.

Geo. Osborne.

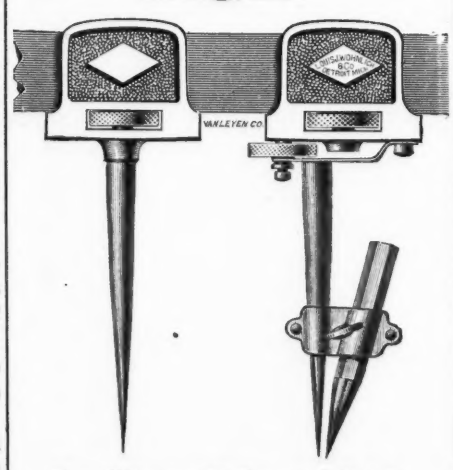
Hawaii, Hawaian Islands.

### Solid Leather Polishing Wheel.

These wheels are made in three grades, denominated soft, medium and hard. They are adapted for all kinds of polishing for which a wood leather-covered wheel is ordinarily used. They are made of disks of oak tanned leather, held together by elastic water-proof cement, compressed under strong pressure.

They are water-proof and may be washed and cleaned when a new emery coating is required. They can be run at any desired speed without danger of bursting.

The New York Supply Company, 52 John street, New York, are the manufacturers.




### The "Diamond" Trammel Points.

The trammel points herewith illustrated appear to be designed to overcome some of the objections found in such tools as ordinarily constructed.

It will be noticed that the method of clamping the heads has been reversed; that instead of clamping at the top these clamp at the bottom by means of the milled nut shown. It will be appreciated that, with the trammels in position to use, if the clamping nut is loosened it drops away from the bar, and the head is free to be moved on the broad surface at the top, without interference of screw and gib.

For making the fine adjustment required for accurate work, one of the points is fastened to a piece of steel, spring tempered. This piece is secured to the head by a screw. The opposite end of this steel piece is forked to fit the grooved neck of a milled nut, this nut fitting a screw secured to the head. It will be understood that with the trammel set conveniently close, a turn of the nut in either direction will move the point correspondingly, by which means exact distances can be quickly set. The screw on which the adjusting nut works is provided with a head, so that the nut cannot carelessly be turned so far as to injure the spring piece.

The pencil holder is so made as to take in a whole length pencil.

The adjusting devices are so arranged that one hand only is required to adjust; thus the trammel may be held in the left hand, one point on the standing line or point, and the adjustment readily made with the right hand.

The manufacturers are L. J. Wohnlich & Co., Detroit, Mich.

### Boiler Inspection in New Jersey.

A bill now before the legislature of New Jersey provides for the periodical inspection of all steam boilers in use in the State, and the examination and licensing of all engineers in charge of steam boilers. To carry this out it is provided that a chief and deputy inspector shall be appointed in each congressional district in the State. The deputy inspector must be a practical engineer, but nothing is said about the qualifications of the chief inspector. The cost to the owner for inspection is placed at five dollars, and to the engineer for a license, two dollars. The bill also provides for the appointment of other inspectors, if found necessary, who must be practical engineers. If complaint is made against an engineer after he receives his license, his case is to be investigated, and his license may be revoked. Engineers in the State very generally approve the bill, except that they think the chief inspector should be an engineer, and that boilers inspected and insured by insurance companies should be exempt from further inspection. In these two points we think they are right. We think chief inspectors should be first-class engineers, and can see no reason why inspection by insurance companies, which has generally been found very satisfactory, should not cover all the necessities of this case. A careful examination of the requirements of this law will undoubtedly lead boiler owners to favor it.

### Gang Band Saws.

We recently made inquiry of J. A. Fay & Co., of Cincinnati, Ohio, regarding gang band saws, and have received the following reply:

We do not manufacture a band saw made to carry more than one blade. A machine carrying two blades is manufactured in England. We do not think, however, that it would answer for the lumber that we have to re-saw in this country. In England their lumber is sent to the market in the form of deals, which are 2", 2½" and 3" thick, and 9" and 14" wide. These deals have to be re-sawed into thin material, and it usually requires several cuts to do this. In our country the majority of the lumber is sent to the market 1" thick. A gang saw is used very largely in England and on the Continent, while with us here in this country it is seldom used, except in the large mills where they use gangs for sawing up logs. We give you this explanation to show you that we are not behind in anything that is really required in this country.

We should suppose that if gang band saws were specially required in any work in this country it would be in sawing, from the log, expensive imported lumber, such as mahogany, and some of the woods used in finishing the interiors of costly houses. In sawing up such lumber, even a small waste prevented would mean money saved.

A sheet-iron newspaper (imitation), designed for those prowling and dishonest persons who steal papers that do not belong to them, is an innovation that will be hailed with delight by all honest newsdealers. The paper contains a rat-trap attachment and a buzz saw, which is worked by concealed machinery, duly and properly wound up in the morning. A tramp or dishonest person

pouncing on the newspaper sets the machinery in motion; the iron jaws of the rat trap close over the hand of the thief, and the saw gets in its fine work with the most discouraging effect on the kleptomaniac.—*Newsdealer and Stationer.*

[And it might be applied with good results to the newspaper fiend who cribs without giving credit.]

## Brown's Vacation, and Its Results.

By Ancient.

For the first time in thirty years, Brown took a vacation, late in the fall, or properly speaking, in the early winter months, when, from past experience, he thought business would be dull. The vacation was spent, not at fashionable resorts, but in patiently investigating the progress which has been made in the mechanical world during the past thirty years, and pursuing his investigations in the branch of mechanics which is most familiar to him, namely boiler shops. It is needless to say that Brown saw much that was new; but he is so wedded to past ideas that he gives no credit to the inventive genius of those who have devised labor-saving machinery, and is still as great a believer in the old methods as ever. Speaking on the subject during an evening chat and smoke, friend Brown freely gave his views on men and machines met with in his travels. For the compressed air riveting machine he entertained the most profound contempt; for the steam riveter, surprise that any one would buy a boiler made with it; while the cup or snap riveter he sneeringly alluded to as bad. The only tool in boiler building which meets his approval is the "flexible shaft," which he found in several boiler shops, used to tap and put in stay bolts. This he thinks is a good thing.

His casual acquaintance with shop foremen does not excite admiration or praise of their ability; shop managers, with whom he formed acquaintance, are placed on the same level.

During Brown's absence, business got quite lively with his partners, and it became necessary to give charge of the shop to one of the old hands, and although "Joe" had in many instances been a sort of scape-goat for Brown's profanity and censure, he was selected by the firm as the most reliable man for the position—not, however, without doubt as to his being able to perform the duties, and with a resolve on their part to carefully watch that no mistakes were made, as Brown had said that "Joe didn't know enough to get out of his own road." In addition to the doubt thus expressed, Joe's quiet way had led all hands to expect that he would not be able to manage the unruly element usually found in boiler shops.

Joe had a fair understanding that he was invested with full power to hire and discharge, reward or punish delinquent associates; he would not accept the position otherwise. Some of the boys thought Joe was putting on airs, and felt elated to think his authority was for a short time; but they kept their thoughts for themselves, and waited the effects of Joe's expected confusion and errors.

Brown, as I have already stated, was very profane, and when in anger his voice could be heard all over the shop, no matter what the noise might be. Joe is gentle-spoken, slow of speech, and says but little. For a few days there were indications of excitement and expectation. This was noticeable after a car load of iron had been left at the shop and the plans of several boilers committed to Joe; but the latter manifested no excitement whatever, simply adapting himself to circumstances, and proceeded to lay out the work with the ease of a veteran foreman. Every sheet was laid out accurately, as was proven when the work was put together. There were a few innovations on old methods, such, for instance, as staggering rivet holes in double-riveted seams, where before they were square, and this, involving a different spacing between centers, gave rise to doubt as to the work being tight when tested. One of the older hands was so much interested in this matter that he took his theories to the office, and thus occasioned alarm in the minds of the firm, which they mentioned to Joe; but he told them the world was moving right along, and although not much of a scholar he tried to move with it by reading the views of able men, as expressed in mechanical papers; in fact, he expressed himself so coolly and confidently that confidence was restored. Joe was told who the tale bearer was, but took no more notice of the matter than to say, "He is a good man—means well, but is blinded by his living in this town all his life, and knows nothing of what is going on outside of it."

Joe got out six boilers the first month of his foremanship, and the time on the six, when compared with that on similar boilers, showed a saving of money in his favor, while the test of the boilers fully endorsed the correctness of his views. He was looked upon with respect by the workmen, while the firm were loud in his praise. Joe discharged a few of the "old hands" in the meantime, and introduced a new element in the shop. Those anxious to retain their places worked hard, creating a rivalry which led to greater economy in the following month's work, and which continued to increase. Brown's capacity consisted in keeping one gang of men and bulldozing them constantly. Joe took all the men he could work and let them bulldoze each other in their efforts to keep ahead; as for him, he had neither time nor inclination for such things.

Joe's wages were raised twice in this time, greatly to his surprise. But Brown's associates knew what they were doing, and as Joe's efficiency increased, they thought it would be a good thing to permanently retain him in charge of the shop, and as Brown was the only surviving member of the original firm, concluded it would be a good idea to give him the same salary he always drew, in addition to his interest, and let Joe remain in full charge. Brown, on his return, was greatly surprised to know that business had revived during his absence; but his surprise was tenfold greater when informed of the change contemplated by the substitution of Joe for himself. No use talking to him about being old, well off and needing a rest; no use talking of paying him a salary for doing nothing. He had lived thirty years in harness and expected to retain the same as long as he could, and wanted no help from any one. His associates were firm, however.

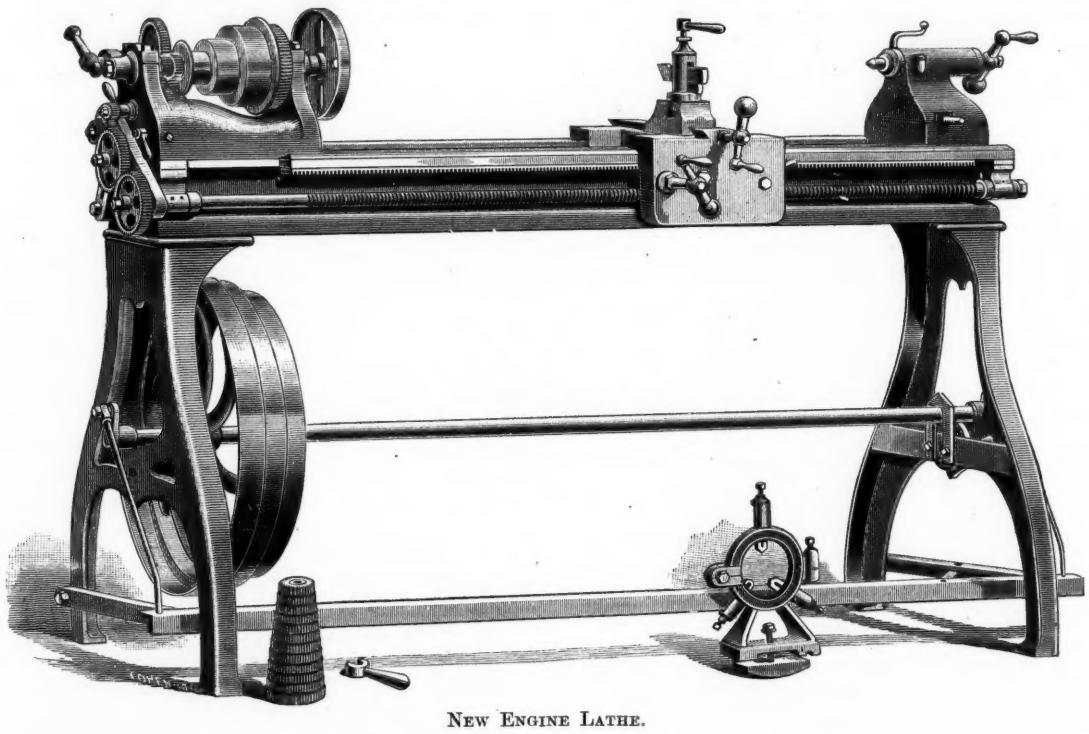
I try to console Brown, but expect he will start a boiler shop of his own, where he can amuse himself by tinkering away, believing he is working for a living.

The *American Journal of Railway Appliances* has changed to a monthly issue. In an editorial explaining the change, it says: "We must frankly confess that we undertook too much."

According to the *Electrical Review*, about 3,000 gas lamps were dispensed with in the city of Brooklyn, N. Y., in 1885, to make room for electric lighting.

Paper rails are talked of for railroad purposes in Europe. If paper rails, why not paper ties?

Never put in an upright shaft when it is possible to do without it. Upright shafting is almost always a source of trouble, and needs constant attention to keep it approximately in place.



New Engine Lathe.

## New Engine Lathe.

The illustration represents a lathe recently brought out by Sebastian May & Co., Cincinnati, Ohio. It is designed to be used either as a foot or power lathe, and has a three-speed cone, balanced for high speed. The spindle is run in gun-metal boxes, with provisions for taking up wear and preserving alignment. The lathe shown swings 12″. The front bearing of spindle is 1 7-16″ diameter and $2\frac{3}{4}$″ long. Spindle is of steel, with 7-16″ hole through it. Right and left hand threads are cut by simple reversing arrangement in the head.

The rack and gears are all cut from solid stock. The carriage is gibbed to the bed, both front and back. The fly-wheel weighs 130 lbs., and is so balanced as to always stop in position to start.

Either countershaft or foot-motion, as desired, is furnished.

C. G. Roberts, Haslemere, Surrey (Eng.), has invented and recently perfected a rain-water separator, which, when applied to water conductors from roofs, will allow a certain quantity of water to wash the roof and pass into the sewer or waste pipe. Then the device automatically turns the stream of water into the storage reservoir. A further improvement in the device, in case of showers quickly succeeding each other, dispenses with the washing device and turns the water direct to the cistern.

The State Department at Washington has issued a pamphlet belonging to its series of U. S. Consular Reports, entitled "Scouring of Wool in Belgium, Great Britain and Germany." The pamphlet illustrates three machines used in Belgium for this purpose.

No. 3, of N. J., N. A. S. E., Newark, N. J., occupied their new rooms, specially fitted up for their use, for the first time last Monday evening. Their rooms are at 120 Market street.

## Electrical Notes.

WEIGHING THE ELECTRICAL CURRENT—TESTING DYNAMOS — ELECTRICAL PROTECTION FROM FROST.

At a recent meeting of the Royal Society of Edinburgh, says *Engineering*, Prof. Blythe, M.A., described a method of finding the strength of an electric current by means of an adaptation of the chemical balance. He said that he had been driven to try this method owing to the difficulty experienced in measuring currents in the ordinary way by the tangent galvanometer in a laboratory where there was a great deal of iron, and especially a dynamo machine. The apparatus depended on the calculation of the attraction between two parallel circles of copper wire of a certain radius at a certain distance apart. He had found that in such a case each time that the same current was passed through the copper wire an invariable result was obtained. In the apparatus which the learned professor described, these circles of copper wire were made to take the place of the scale pans of the balance, the wire being carefully insulated between disks of glass. The current was made to pass through the coils over the scale beam, and through the support of the scale beam, care being taken not to interfere with the sensibility of the balance.

A new method of testing the efficiency of dynamos, which was suggested by Dr. J. Hopkinson, F.R.S., was recently tried at the works of Messrs. Mather & Platt. The dynamos are coupled with their shafts in line and driven by the same driving pulley and belt, situated at the center of the joint shaft. One machine was employed as a generator, the other as a motor; and the engine only supplied the difference or loss of power in the electrical arrangement, since the dynamos were connected in circuit so that the generator drove the motor, and the same current of 521 amperes passed through both armatures. It is stated that the method allowed of a determination of efficiency to $\frac{1}{3}$ per cent., instead of 3 per cent., as by the usual method. The machines showed an efficiency of 93 per cent.

The damage which may be done in vineyards by frosts in spring is so serious that in some districts great care is taken to light fires as soon as the temperature falls dangerously near to freezing point, and to create clouds of smoke over the vineyard to prevent radiation as much as possible. In one district of France a telegraph inspector, Lestelle, has introduced an ingenious arrangement for rendering this smoke protection automatic, and applying it as speedily as possible in moments of danger. In the center of the vineyard he places a mercurial thermometer. When this falls to two degrees above freezing point, the mercury closes the circuit of a small galvanic battery. This sets in motion a commutator worked by clockwork, which sends the current from a small Ruhmkorff inductor through several circuits of wire in succession. Corresponding to each of these circuits is a heap of suitable combustibles laid ready and an ignition apparatus, which is fired by the current. These heaps of fuel are placed some forty meters apart, and are, of course, so composed that their ignition is certain, and that they will smoulder and give off a maximum of smoke. With this apparatus the costs and the unreliability of night watchmen in early spring are done away with, and also the delay attendant on lighting the fires. If a sudden frost comes on, the whole vineyard is enveloped in a few seconds in a cloud of smoke. The cost of the apparatus is given as £4 10s. per hectare (equal to 2.47 acres), for which space seven fires are necessary to insure perfect protection.

The "smashing" machinist is hardly ever a nice workman. He may be a valuable man on cheap, rough work, but he never gets a call to work to micrometer measurements.

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## Photographing Machinery.

Every machine builder has experienced trouble in getting photographs of machinery when he wanted them. It often happens that a machine is not quite ready at the appointed time, and it usually happens that the photographer is *never* ready when you want him, and valuable time is lost owing to waiting for the artist.

Dry plate photography has been brought to such a degree of perfection, and its processes so simplified, that it would be to the advantage of every machine builder to possess photographic apparatus of his own.

Like everything else, photographs cannot be made until you know how; but the art, as far as need be practiced by the mechanic, is easily acquired, and will prove of great value when once understood.

It may happen that a machine is to be shipped at once. The photographer is sent for in a hurry; ten chances to one he is in a hurry on his own account, and the shipment must be deferred or photographing dispensed with. In the drafting room, photographing has a great work to do, which as yet has hardly been commenced.

Valuable plans may be photographed to a small size, which admits of their being preserved in a very compact form, saving the expense of commodious storage safes, and also, by duplication, rendering the preservation of a copy almost certain by copies being filed in many different places.

As such photographic copies can be enlarged to full working size without loss either of scale or of sharpness of line, their value in case of fire is apparent. Ordinary drawings, which it is desired to enlarge or reduce to a different scale, may be readily treated by photographing, and with the assurance that the results are accurate copies. Even in the foundry, the camera will eventually be brought into use. Mixtures of iron, when broken in a testing machine, may be put permanently on record by photographing the broken ends, showing the fracture and its characteristic features so truthfully that it admits of no contradiction.

The exigency of getting a living, and this is especially true in large towns and cities, compels many children to begin work when they ought to be at school. This is unpleasant, but it is nevertheless a fact. As labor makes the wealth which pays taxes, it is no more than an act of justice that children thus compelled by circumstances to work through the day should be provided with facilities for pursuing in the evenings the studies they have dropped. To this end evening schools, including those equal in every respect to the "high schools," now a part of the school system of most towns and cities, should be established. This would enable many an ambitious young man to do with greater dispatch and less labor what he will probably do anyway, viz: acquire a fair education of the kind attained in schools. In these times the need of education is pressing, and every facility for its acquirement should be provided. As previously intimated a young man of the right quality is likely to learn anyway, but as the labor of those who are obliged to work in years when they ought to be at school goes to enrich the community, they have a right to demand that the way be smoothed for them.

## Consider It on Its Merits.

A bill has lately been introduced in Congress to appropriate $50,000 for the purpose of boring a number of artesian wells in New Mexico, with view to test the irrigating possibilities of that territory, and in the hope of making available for cultivation large tracts of land which are now nearly valueless. We notice considerable unanimity of sentiment against the bill on the part of the daily press, which has noticed it, all condemning it because it proposes to do something, the doing of which should be left to private enterprise.

There are one or two points that deserve attention in making up an opinion regarding this measure. The territory is administered, as are all the territories, by the general government. Most of the land comprised in it is owned by the general government. Under these circumstances, we do not exactly see what inducement there would be for private enterprise to bore the proposed wells, unless it were agreed that large tracts of land should be surrendered to them as a return. Such a surrender would operate directly to exclude the small farmers, whose presence upon the lands would be of far greater value to the country than that of any other class of cultivators. Why should not the general government owning these lands, consider the merits of a proposition to spend a relatively small sum of money to make them valuable, exactly as a private individual would do, who should happen to own them?

We think the bill should be considered on its merits as a business proposition, and not be condemned on general principles.

## Idle Convicts and the Prison Labor Contract System.

A palpable and prolonged attempt is being made by the politicians who so largely make up the New York State legislature, to restore the prison labor contract system by the simple expedient of doing nothing. The proposition seems to be, to leave a large number of convicts unemployed, and then to charge up the net result of this course to the account of those who objected to their employment in a manner that was unfair to honest labor. No honest opponent of the contract system wants the convicts to spend their time in idleness, and the studied refusal of the representatives of the people to substitute a proper system of employment in the place of the system the people voted to abolish, will be understood by the people.

The legislative partisans of the contract system divide on different lines, and assign different pretexts in excuse for their action, or rather, want of action, but all are working for the same result, viz.: to pile up a huge bill of costs for the maintenance of idle convicts, and then point to it as an argument for the restoration of the contract system. We have faith to believe the people of the State will take note of this little game—and act accordingly.

## Trade Journalism.

In commencing its third year of publication the *Journalist*, in a leading editorial, announces its intention to devote more attention hereafter to trade journals and trade journalism, recognizing the importance of the influence which well established publications of this kind are able to exert upon the industries and interests with which they are so closely identified. The daily press and those connected with it, have, in the past, generally been disposed, if they did not unduly magnify their own office, to exaggerate its relative importance in the field of journalism. In so doing they as naturally underestimated the value to the community of those unsensational but substantial advances which are all the time being made in industrial methods and results. It is fair to say, that industrial transformations and revolutions are constantly going on under their very eyes, that largely escape the attention of the daily press, a knowledge of which would be worth more to the community than a large part of that which meets their eyes in the daily journals. It is a healthy sign that journalists are beginning to recognize that industrial policies are as important as politics, and shop topics as interesting, to large numbers of readers, as society notes or scraps of scandal.

## Steel in Machine Construction.

Time was when the legend, "All shafts and screws of steel" told a good deal of added cost in machine construction. Steel was, as compared with iron, expensive, both as to first cost and to work. Now, owing to the cheapening of steel-making processes, there is but little difference as to cost between steel and iron, as used for most purposes in machines and machinery. The cheap grades of steel are easily worked, and answer ordinary requirements nearly as well as the higher qualities of cast or tool steel—sometimes even better—and have quietly come into almost universal use. This has, in one sense, that is, so far as material cost of construction is concerned, destroyed the pertinence of the legend referred to, but so far as utility is concerned, it has not particularly affected it. The cheap process of producing steel of sound section has undoubtedly had the effect of improving the quality of the more common class of machines and machinery in which the use of costly grades was hardly admissible on the score of cost, and has, in many instances, cheapened the better class of machinery.

In boiler construction, steel is slowly finding place; it is evident that considerable is yet to be learned, both in the manufacture of steel plates for boilers and in working them in the boiler shop. With further advance in these directions there is little reason to doubt that steel will practically supersede iron in boiler construction. The only question will be one of endurance, which, owing to the comparatively recent use of steel for this purpose, has hardly been settled, except, perhaps, in the instance of some parts of locomotive boilers which require frequent renewal.

## Queries for Shop Proprietors and Superintendents.

How many shop proprietors and superintendents think they have reason to feel satisfied with the number of times they succeed in turning their capital yearly?

How many such individuals have carefully considered the subject during the past year?

How many are systematically carrying out plans enabling them to make their capital more productive?

How many have found insufficient or inefficient tools and equipment chiefly to blame?

If all who so find should order, on an average, one new tool each, during the next month, on account of such an investigation, what would be the probable effect on the prices of machine tools?

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.*

(163) E. T., Atlanta, Ga., asks: What saving, if any, can be made by using a steam pump and heater, over using a :: injector for boiler feed? *A.*—We are not aware of any experiments that have been made in a manner to settle this. The relative economy would depend upon the kind of pump used and to some extent on the injector used. Probably with a steam pump and a good heater as against an injector without a heater, the economy would be in favor of the pump. But a heater may be used with the injector as well as with the pump. Then it seems probable there would not be much difference. Still it is one of those questions that cannot be settled except by the most careful experiment.

(164) P. F. D., Syracuse, N. Y., writes: Having put in a ventilating or exhaust fan, I find it will not run. The belt slips on driven pulley. A quarter twist belt runs from a 28″ driver, making 74 revolutions per minute to a 9¾″ driven pulley on counter shaft, and another belt from 24″ pulley to a 9″ pulley on fan. Both belts 4″ wide. When started it will run all right for about three hours and then the twist belt will run off the driven pulley. Can I get more power by putting another belt over the quarter twist, or would a rubber belt the same width run it? I have not room to use a wider belt. *A.*—A rubber belt would not under these circumstances help matters much. As a wider belt can not be used, we should put in larger pulleys for the quarter twist belt. Probably pulleys 36 and 12 inches in diameter, would drive the fan. Putting one belt over another is not a scientific or mechanical method of dealing with an over-loaded belt. More belt surface, or higher belt velocity are the correct methods of increasing the amount of power a belt will transmit.

(165) T. D., Lima, Ohio, asks for a simple rule whereby he can tell off-hand the power of an engine? *A.*—Multiply the area of piston by average steam pressure and again by travel of piston in feet per minute. Divide by 33,000, and quotient is the horse-power. 2. How can I find the weight to be placed upon a safety-valve having a given length of lever, in order to have it blow at a given pressure? *A.*—Balance the lever upon a knife-edge, measure the distance from this point, which is the center of gravity, to the inner end of the lever, multiply this length in inches by the weight of safety-valve and lever, now multiply the length of short arm of lever, area of valve and steam-pressure together; subtract the first product from it and divide the remainder by the whole length of lever. The quotient will be the weight to be placed upon the lever.

(166) J. H. E., of Chicago, Ill., writes: We have a 30"x60" Corliss engine with a 14" exhaust pipe. We wish to use the steam for exhaust heating purposes, and propose to put in a back-pressure valve set to two pounds. 1. We now carry 60 pounds boiler pressure. Can we do the same work after the back-pressure valve is in, by carrying two pounds higher boiler pressure? *A.*—Should carry, say 65 pounds to do your work, cutting off at about the same point as now, if you increase the back-pressure by two pounds. Your engine may be large enough to do your work satisfactorily without increase of boiler pressure. 2. What difference will it make in the coal consumption? *A.*—Probably about seven per cent. 3. The engine is now cutting off at ¼ stroke. Will it be necessary to change the point of cut-off? *A.*—Your engine being automatic will cut-off wherever it is required to do the work; this will take care of itself.

(167) A. L. M., Colchester, Conn., asks: What is a good welding preparation? *A.*—Borax and good iron filings from good Norway iron. 2. How will I repair tin cylinder for a cotton mill spinning frame? *A.*—Take it to a "tinker." 3. How will I find the horse-power of an engine? *A.*—A formula is given in Question and Answer 302 in the AMERICAN MACHINIST of Oct. 31, 1885. 4. I do not understand how to make a diagonal wrench. *A.*—Instead of having the jaws straight with the handle, make them at an angle of 15° to it. 5.—What is the standard size for bolt heads for ¼", ⅜", ½", ⅝", ¾", and 1" iron? *A.*—As determined and adopted by Committee of the Franklin Institute of Philadelphia in 1864, the sizes for *rough bolt heads* are as follows: "The width between the parallel sides of both *head* and *nut*, 1½ times the diameter of the bolt, to which is to be added ⅛ of an inch." "The depth of the head is half its width. The depth of the nut equals the diameter of the bolt. For *finished* bolts, the width between the parallel sides of both head and nut is 1-16 of an inch less than for a rough bolt." "The depth of the nut is 1-16 of an inch less than the diameter of the bolt." By the above, the size of a ½" bolt head would be ⅞" square by 7-16" thick in the rough. When finished, its size would be 1 3-16" × 1 3-16" × ½", and wrenches may be made accordingly.

(168) V. M., Warsaw, N. Y., asks: Would it be advisable or economical to carry steam 2,000 feet from boilers, with 100 feet rise, to pump a well 140 feet deep, It will take from 4 to 6 H. P. to pump what water is needed, and what size steam pipe will it take if it can be done? *A.*—Steam would be the most economical means of transmitting power to such a distance, but it would be rather expensive. At least a 1¼" pipe would be required, with 60 lbs. boiler pressure, and then the pipe must be well protected by some non-conducting material. Probably 1½" pipe would be better. According to a table in the AMERICAN MACHINIST of June 9, 1883, steam at 60 lbs. pressure, passing through a 1" pipe, would convey about 12.7 H. P., but would lose .38 H. P. for every 100 feet of pipe. 1½" pipe would convey 30.4 H. P., and lose .54 H. P. per 100 feet. A 1¼" pipe would carry about 20 H. P. and lose .45 H. P., or 9 H. P., while traveling through 2,000 feet of pipe, leaving about 11 H. P. for actual work. If an engine was used, this power would probably be realized, but with a pump but 5½ or 6 H. P. will be developed.

(169) T. C., ——, Mass., writes: I have got a thread-cutting lathe which has no indicator. Which is the best way to find the correct gear to cut any number of threads to the inch? *A.*—Consult the AMERICAN MACHINIST, page 4, August 20, 1881. 2. I have got two pieces of steel; one is 3 ft. long by 1¼" in diameter at large end. I wish to turn this piece tapering to ¼" at small end. How far shall I set over the lathe tailstock? *A.*—Three-eighths of an inch,. 3. The other piece is 1 foot long by ¾" in diameter. I wish to taper this piece so one end will be ½" in diameter and the other end 3-16". How far shall I set over the tailstock in this case? *A.*—5-32". 4. Are there any rules for turning taper? *A.*—Yes. Regard the length of taper as the perpendicular of a right angle triangle; ½ the difference of diameter of the ends as the base, and set the tailstock over accordingly. When the taper runs entire length of work the offset is equal to ½ difference in diameter of ends; but where the length of taper is but a fraction of length of rod, ½ the difference of diameters must be multiplied by the number of times length of aper is contained in length of work.

(170) C. H. B., Pawtucket, R. I., writes: Sometime since, in answer to a question about boilers, you answered that probably the escaping gases were too hot. I have no doubt this is true, but how can I remedy it? My boilers are cylinders, 30" diameter and 16 ft. long. The grate surface is 17½ square feet. Front and back bridge walls are 6" from shell. From this shell the flue drops 2½ feet below the rear wall, and enters the chimney. With a strong draft, damper opening 8 square feet, what will be the horse-power of boilers? *A.*—Cylinder boilers are not economical in the use of fuel at the best. Your boilers are too short, and you are probably forcing them too hard. One of your boilers would have less than 65 feet of heating surface, and, according to the usual rating of such boilers, would be about 7 horse-power. The usual proportion of grate to heating surface in cylinder boilers is one to 10 or 11. About the shortest length they are made is 8 diameters, and this is too short. We do not see how you will be able to help yourself much.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.*


Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

Alt, Mechanical Engraver on Wood, 318 B'way., NY

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N. Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Screws and turnings in brass, special shapes, estimates made on samples; Ottumwa Iron Works, Ottumwa, Ia.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philaddelphia, Pa.

"Morrison's Practical Engineer." A complete treatise (200 pp.) on steam and general mach. Mailed on receipt of $1. W. A. Morrison, Box 373, Lowell, Mass

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See April 3, p. 14. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

10,000 users machinery, tools, steam engines, boilers, etc., in N. Y. & N. J. Best *Trade Directory* ever issued. Send for circular. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

Raney & Berger, New Castle Pa., are the manufacturers of the celebrated Norway Foundry Iron referred to in Robert E. Masters' article on "Strength of Different Mixtures of Cast Iron,' in the AMERICAN MACHINIST of March 27, 1886.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2, post-paid. For sale by John Wiley & Sons, 15 Astor Place, New York.


## MANUFACTURING

A co-operative rolling mill is talked of at Jackson, Ohio.

E. L. Donnell, Monmouth, Me., will build a machine shop.

Bernhardt & Rodgers are building a large steam saw-mill at China Grove, N. C.

The Arkadelphia (Ark.) Lumber Co., will build several mills during the year.

W. B. Busch will build a large circular and band saw-mill at Marquette, Mich.

James H. Pratt is building a factory at Southington, Conn., for making shears.

Fuller & Legroo will build a shovel-handle manufactory near Wilton Depot, Me.

Charles H. Mills, Lowville, N. Y., will build brick and tile works at that place.

The Chicago, Ill., Safe and Lock Co. propose to enlarge their plant.

John West, 1508 Susquehanna avenue, Philadelphia, Pa., will build an addition to his mill.

W. S. Smith will build a band saw-mill at Cheboygan, Mich.

Thompson & Company are building a large foundry at Pittsburgh, Pa.

W. B. Morse, Rochester, N. Y., intends to build a large five-story factory.

Power Bros., Ferry, Mich., will build a flour mill next Spring.

The Central Iron and Steel Co., Brazil, Ind., have increased the wages of their puddlers and rollers.

Hilton & Erwin, Rock Island, N. C., will build a shuttle-block factory.

A company to be known as the John W. Page Manufacturing Company has been incorporated in Chicago, to build boilers.

The Flint & Walling Mfg. Co., Kendallville, Ind., will at once erect extensive buildings for a wind-mill factory.

The Grand Rapids and Indiana Railroad Company intend to build new shops in Grand Rapids, Mich.

The Globe Woolen Co., Utica, N. Y., intend to enlarge their factories by the addition of a new worsted mill, 204x60 feet.

The Youngstown Steel Works, Youngstown, Ohio, are being put in working order for the manufacture of steel ingots. E. L. Ford, Supt.

Rundle, Spence & Co., Milwaukee, Wis., are about to build a factory 50x150 feet, on Fowler street, at a cost of $28,000.

Robert Beatty, 2046 E. York street, Philadelphia, Pa., will build a factory on Coral street, between Taylor and Litterly.

George Kessler, 1332 Marshall street, Philadelphia, Pa., will build a factory and boiler house on Third and Somersett streets.

Atkinson & Myhlerty, Twenty-Second and Market streets, will build an extension to their mill corner of Aspen and Barker streets.

Weakley & Warren, Nashville, Tenn., are building a large brick furniture factory to employ 100 men.

A co-operative manufacturing institution is to be started at Battle Creek, Mich., by the Knights of Labor.

Sohmer & Co., 149 E. Fourteenth street, New York City, will build large piano factories at Astoria during the coming summer.

The Gardner Governor Company, Quincy, Ill., have 50 per cent. more men at work than at any time last year.

Moore & Vehemyer, 65 North Desplaines street, Chicago, Ill., will build a four-story factory at 113-119 N. Peoria street

Shields & Son, Butler, Pa., will build a large glass factory at that place. The main building will be 365x270 feet.

George F. Jackson, Monson, Me., will build a steam factory for the manufacture of slate-lined butter boxes.

Meyer & Ridlin will move their factory from Cincinnati to, and build a large structure at, Covington, Ky.

John I. Beggs and others, of Harrisburg, Pa., have organized "The Rudisill Mining and Milling Co.," at Charlotte, N. C. The capital stock is $200,000.

A permit has been issued to Henry Kerper for the erection of a three-story brick machine shop on Pearl street, Reading, Pa.

C. J. L. Meyer is building a chair factory at Hermansville, Mich., which will employ several hundred men.

The Tuthill Spring Co., Hammond, Ind., propose to give their employes 5 per cent. of their profits as a premium.

The New Albany Rail Mills intend to manufacture merchant bar iron, and are making extensive additions to their buildings and machinery.

J. W. Baum, J. H. Mecaslin, and others, of Atlanta, Ga., have applied for a charter to incorporate the Southern Box Factory. They will manufacture boxes, barrels, baskets, buckets and kegs

The Pond Engineering Co., St. Louis, Mo., have the contract for the pumping plant for the Arkansas City, Kan., water works. Two compound condensing pumping engines, with boilers and accessories, will be furnished.

The prospects are good for a new industry being brought to Saccarappa, Me. Negotiations are pending for the purchase of the skating rink building, with a view of converting it into a manufactory of steel lugs.

Orders were received on March 28 at the railway company's machine shops, says the Altoona, Pa., *Sunday Morning*, for 22 new passenger engines, 10 of class "O," and 12 of class "P."

Their business demanding more room, the Stiles & Parker Press Co.'s branch office and factory in New York City will remove, May 1st, to 203 to 207 Center street.

Any reliable man who will erect a roller mill at Richardton, Dak., can get an advance of $2,000 to $2,500 from C. B. Richards & Co., bankers, of New York, besides a further donation of $1,500 to $2,000 from the inhabitants of the place.—*The Millstone.*

F. Light, Jr., and J. K. Kriebel, lately with the West Point Engine and Machine Co., West Point, will, about April 1, commence a general machinery business at Norristown, Pa., under the title of Light & Kriebel.

Business at G. W. Brown & Co.'s corn planter works, Galesburg, Ill., is looking up. In some parts of the works the men are working 12 hours per day. 72 carloads have been shipped since the first of the year, besides nearly as much way freight.

W. E. Crist, of the Crist Engine Works, 182 Center street, New York, writes us: "My present works are too small, and I have taken a five-story brick, where I am putting in a lot of tools to fill orders. I run till ten o'clock nights.

A fire occurred March 28, at Brainerd, Minn., in the car department machine shops of the N. P. R. R., causing the loss of $100,000 worth of cars, machinery and materials. The shop will be rebuilt at once.

The National Water Tube Boiler Co., of New Brunswick, N. J., have just shipped to the Atlantic Refining Co., Point Breeze, Philadelphia, 328 H.P. of their water tube safety boilers, this making the second order within a few days for this size boilers.

The Paxton and Vierling Iron Works, Omaha, Neb. (formerly known as the Old Omaha Iron Works), will enlarge their facilities, and manufacture all kinds of architectural iron work, vault, sidewalk and platform lights. They will also make boilers, hoisting engines, elevators and general mill work.

Mrs. Jeannie S. Macdonald, of No. 1,533 Park avenue, N. Y., has entered plans at the Bureau of buildings for a four-story factory, which she will erect on the north side of Seventeenth street, 223 feet east of Avenue A. The estimated cost is $18,000.

The Evansville Lead and Spar Mining Co., Evansville, Ind. have succeeded to the business of B. Burbanks & Co., of that place, miners of fluor spar. They write us: "We receive inquiries daily from parties all over this country. This past week we have received inquiries from Liverpool, England, and Prato, Italy.

The Sextro Furniture Co., Cincinnati, Ohio, are now making extensive preparations for building an additional factory alongside i:s present structure on Third street. The new building will be of the same size as the present one, and much machinery which is now up stairs will have a solid ground floor base.—*American Cabinet Maker.*

A number of Pittsburgh capitalists have formed a company for the erection of steel works at Germantown, near Pittsburgh, Pa., on the Pittsburgh, Virginia and Charleston Railroad. The plant will have two five-ton Bessemer converters of the most modern pattern, and operations will be begun by January 1, 1887, giving employment to 250 men. The company has purchased 50 acres of land at Germantown. Geo. Troutman, W. H. Aldred, Geo. Boulton, and others, of Pittsburgh, Pa., are interested.

The shops of the Cincinnati, Washington and Baltimore Railroad, at Zaleski, have been destroyed by fire. Loss, $40,000; fully insured. Thos. G. Duncan, master car builder, Zaleski, O. J. H. Sternbergh & Co., of Reading, Pa., will erect three new shops on the east side of North Third Street. The largest building will be a machine shop, 60x50 feet, and three stories in height, and will be supplied with the latest improved machinery. A steel smith shop, 15x20 feet, will be erected, and also supplied with the latest and improved furnaces and tools. Another brick structure, 19x35 feet, will be built for the grinding and tool department. The new machine shop will be connected with the present machine shop by an overhead bridge. William A. Fink, of Reading, is the architect. It is rumored that the Lehigh Coal and Navigation Company, of Lansing, Pa., are negotiating for the purchase of the Allen Machine Works. Extensive additions will soon be built. Robt. H. Sayre, of Towanda, has offered an acre of land to foreign parties if they will build machine and repair shops thereon.—*New Enterprises.*

The Ferracute Machine Co., Bridgeton, N. J., write us: Business has been "booming" with us for the last two months or so. Orders are coming in from all parts of the country at a rate to considerably exceed our capacity. Although we have been working nights, part of the time, we are now several weeks behind our orders, and there are indications of a continuance of this increasing demand for our tools. We are selling a large number of our new punching presses. Our parabolic single action and drawing presses are also in active demand, and our die department very well employed. We are now building a new wiring press with many improvements and of a design radically different from what has hitherto been brought out.

We have advices from Fitchburg, Mass., to the effect that the consolidation which has for some time been talked of as likely to occur, has taken place between the Putnam Machine Company and the Putnam Tool Company, of that place, under the name of the Putnam Machine Co. An addition of 150x60 feet is being made to the company's foundry

## Machinists' Supplies and Iron.

NEW YORK, April 1, 1886.

The market has been steady and quiet. The demand has been confined almost entirely to low grades.

Iron—In American pig the contract deliveries nearly absorb production. No. 1 X, Foundry, at tide water, $17.00 to $17.50; Standard, Lehigh and North River, $18.00 to $18.50; Grey Forge, $16.00 to $16.50.

Scotch Pig—Quiet and steady. Coltness, $20.25 to $20.50; Glengarnock, $19.50; Gartsherrie, $19.50 to $20.00; Summerlee, $20.25.

## *WANTED*

*"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.*

Wanted—Position as foreman pattern-maker; first-class references. Address Box 6, AM. MACHINIST

Draftsman, expert in gearing and experienced in designing milling machines, lathes, special machinery, etc., wants position. Address E., AM. MACHINIST.

Wanted—By a first-class machinist and draftsman, a position as draftsman; correspondence solicited. Address Myron, AM. MACHINIST.

Mechanical engineer, six years' practice since graduation, wishes to engage with established manufacturing company; specialty, steam machinery. Address Permanent, AM. MACHINIST.

Wanted—A foreman pattern maker, and also one good mechanical draftsman on engine and general machinery in a Western city. Address Cable, AM. MACHINIST.

Wanted—A traveling salesman; one acquainted with wood-working machinery; state age, experience, etc., with expectations. Address Box 440, AM. MACHINIST.

Wanted—A thorough machinist, of pleasing address, wants to travel, representing a first-class machine manufacturer. Address A. T. M., AM. MACHINIST.

Supt. of machine works, experienced designer and draftsman, wishes situation as supt. or manager; steam railroad, or mill work preferred. Address Experience, AM. MACHINIST.

Wanted—For a few months, a mechanical engineer, with long experience in designing and constructing large milling and boring machines, and jigs for machine tools. Address O. P. Q., AM. MACHINIST.

Wanted—Situation; 20 years' experience on various tools, models, and fine machinery; willing to take work on contract; West preferred; also a young man as tool maker. Address Michigan, AM. MACHINIST.

A good, practical machinist, 30 years old, with Government license, wishes a situation as stationary engineer, or engineer in charge; first-class reference; not particular as to location or time of engagement. Address Box 7, AM. MACHINIST.

## ✣ MISCELLANEOUS WANTS ✣

*Advertisements will be inserted under this head at 35 cents per line, each insertion.*

The Cyclone Steam Flue Cleaner has no equal. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Pennington & Mills, 8 Dey st., Jersey City Heights, N. J.

10,000 Users of Machinery, steam engines, boilers in N. Y. & N. J. Best *Trade Directory*. Send for circular. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

Special tools and machines for mfg. designed and built to order; mechanical and Patent Office drawings. Weston & Smith, Syracuse, N. Y.

C. F. Langston & Co., 222 N. 5th st., Phila., can-makers' tools, presses, dies and special machinery built, rotary cutters made and ground.

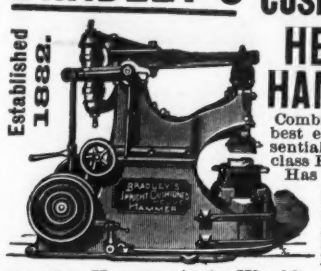
Martin Bros., manufacturers, Lock Box 285, New Brunswick, N. J., will contract for the manufacture of articles in brass and other metals (stamped or turned), and dies and tools for making same; also patent novelties, electrical inventions, special machinery castings, etc.; estimates cheerfully given.

Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until May 1. Address Geo. A. Barnard, 70 Astor House, New York.

For Sale—Canadian patent of J. H. McGraw's Patent Adjustable Tube and Hose-Coupling Expander, the only adjustable roller expander made to a firm with light machinery; this is a good opportunity; used and indorsed by leading firms in U. S.; price low, as my U. S. business is all I care to attend to. J. H. McGraw, 187 W. 8th st., Oswego, N. Y.

For Sale or to Rent—The Honesdale Iron Works, established over forty years and doing good business, are offered for sale or to rent on satisfactory and easy terms, or an experienced man having some capital might be taken in as partner. Apply to M. B. Allen, Honesdale, Pa., or to W. W. Wood, Room 34, 117 Nassau st., New York.


**BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER**

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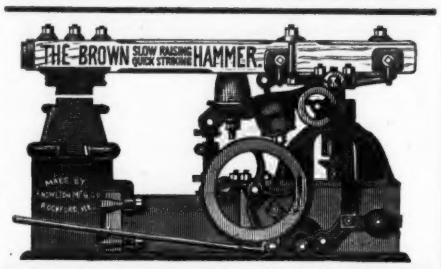


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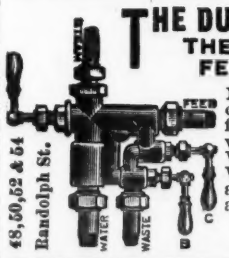


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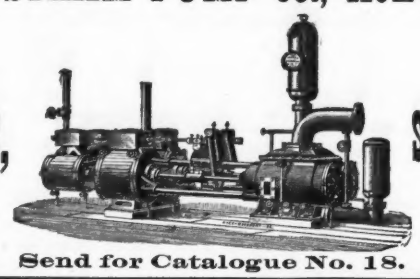

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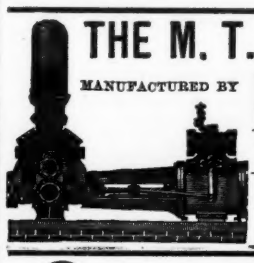

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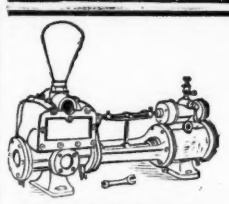

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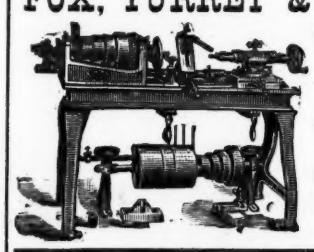

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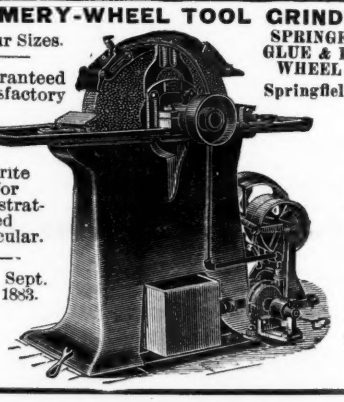

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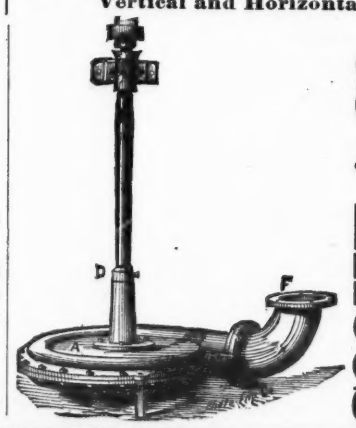


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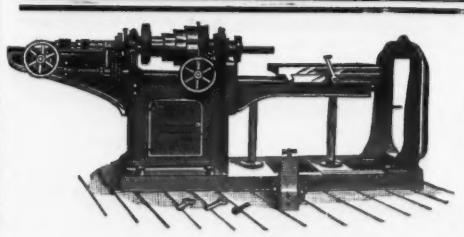

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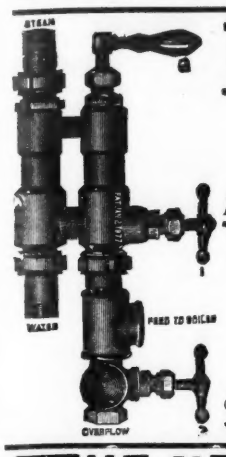


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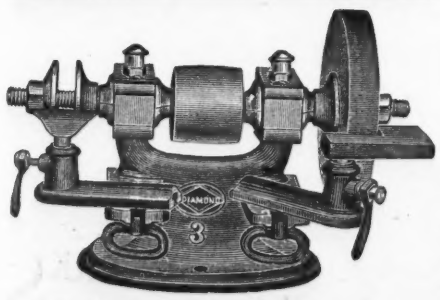


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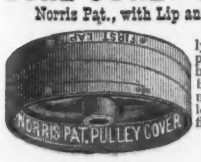


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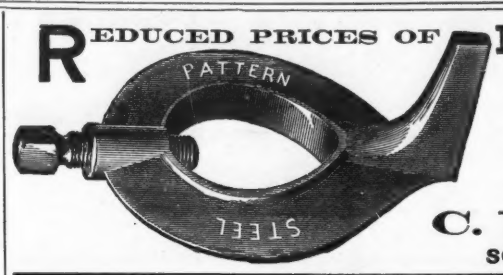


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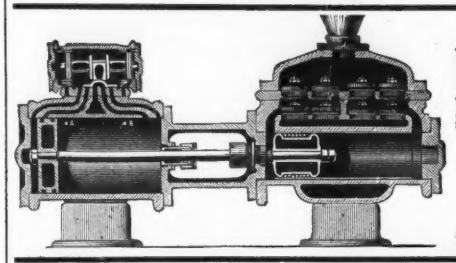

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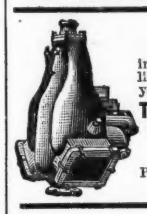

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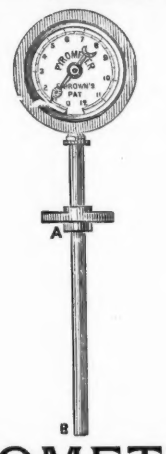


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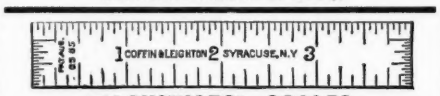


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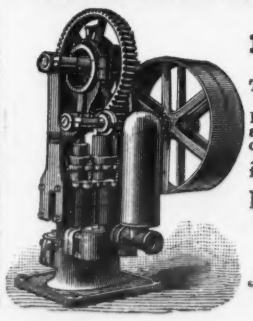

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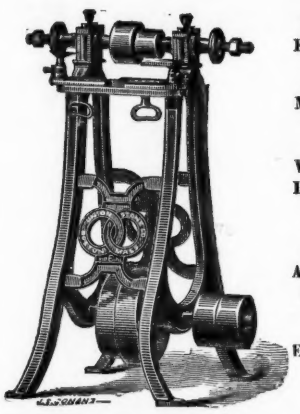

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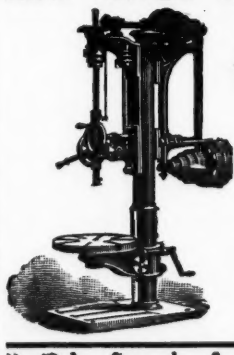

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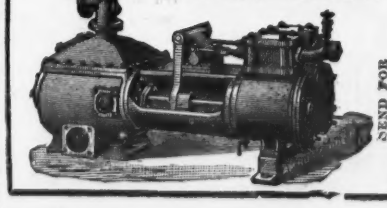

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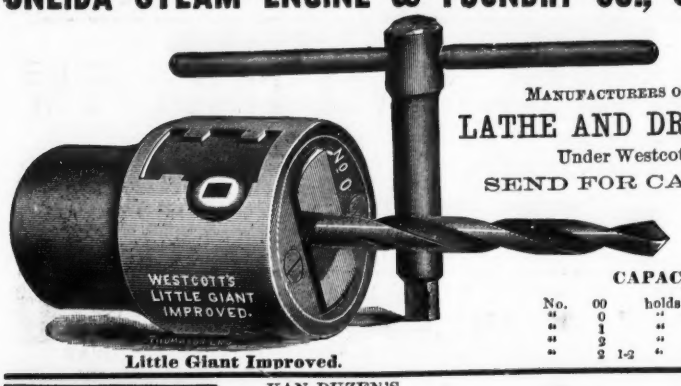


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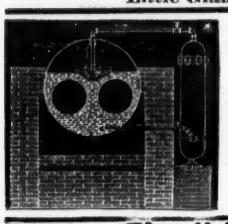

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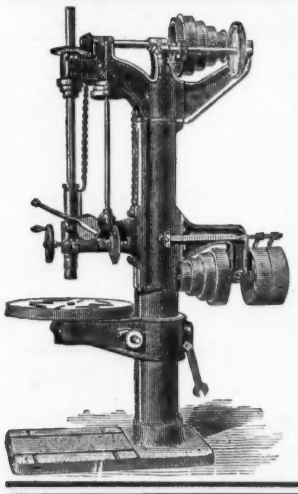

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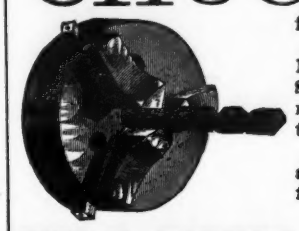

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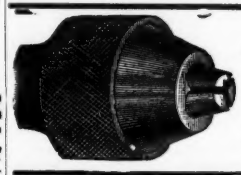

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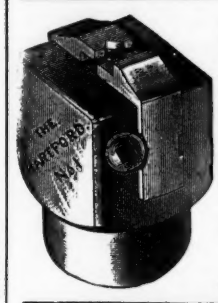

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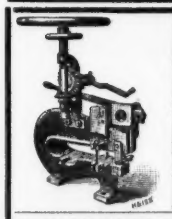

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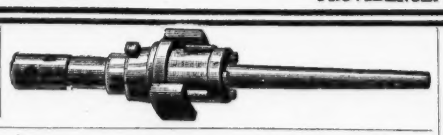

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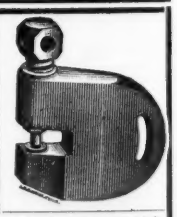

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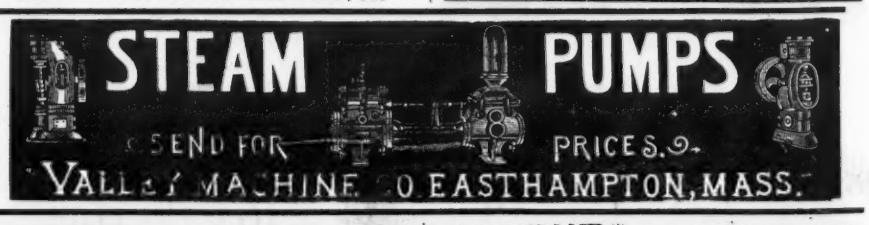


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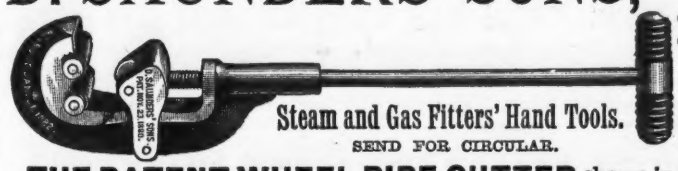

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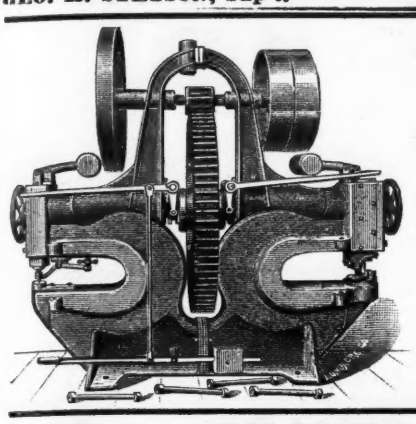

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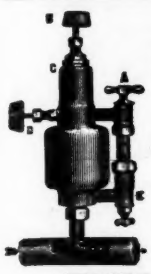

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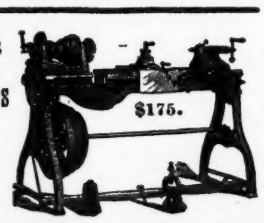

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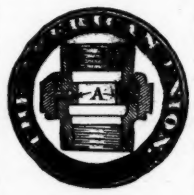

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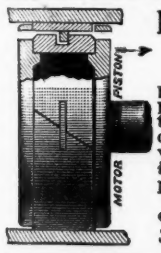


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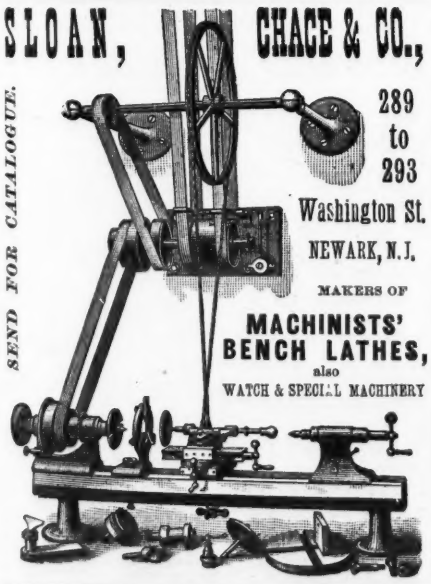

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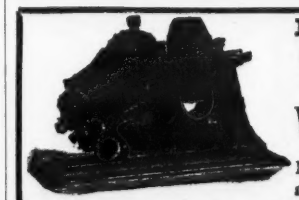

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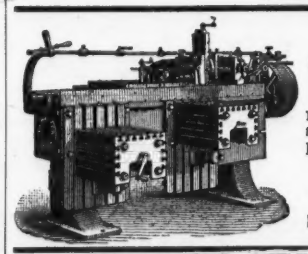

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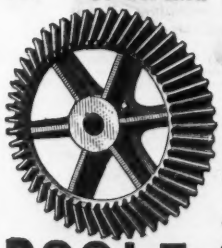

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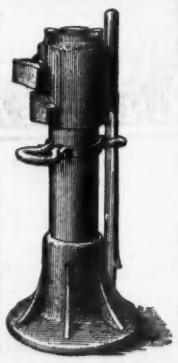

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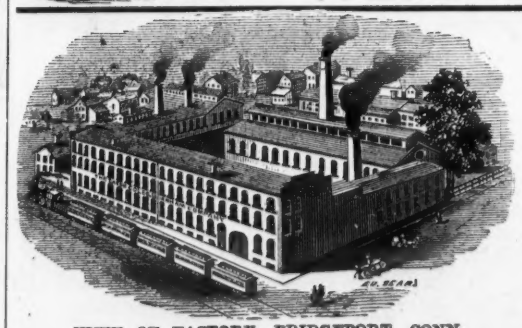

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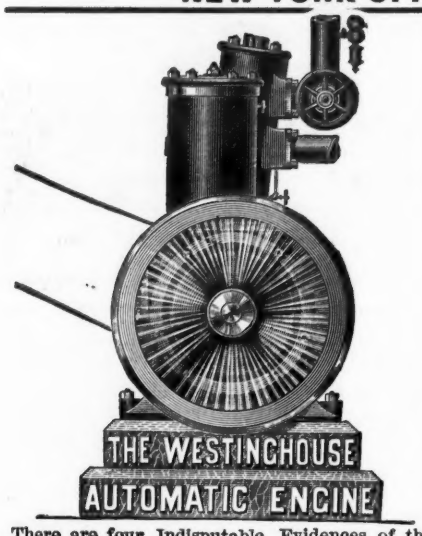


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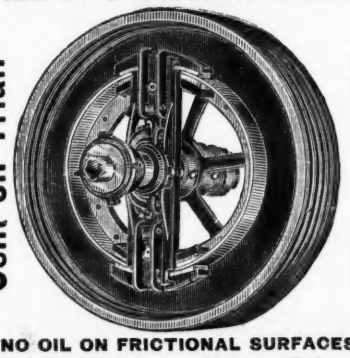

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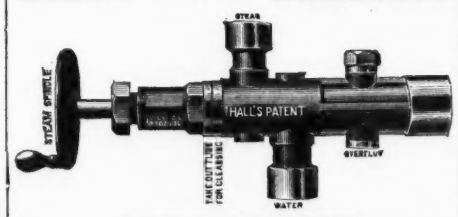


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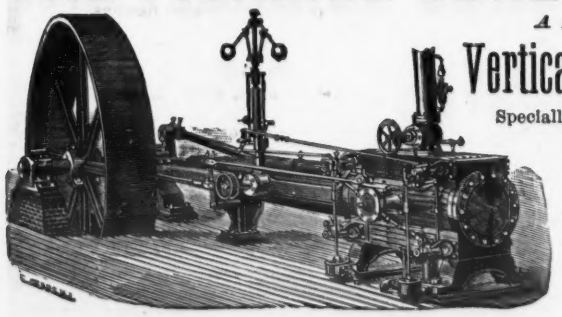

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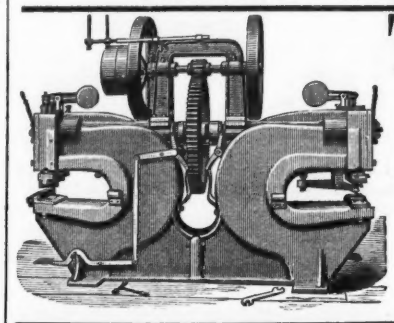

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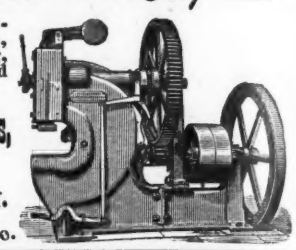

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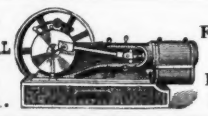

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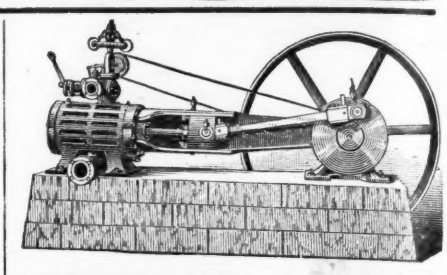

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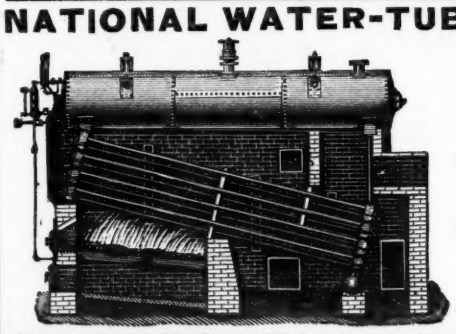

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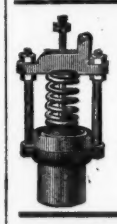

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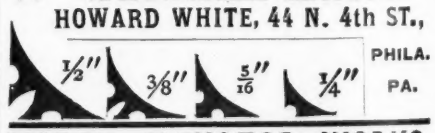


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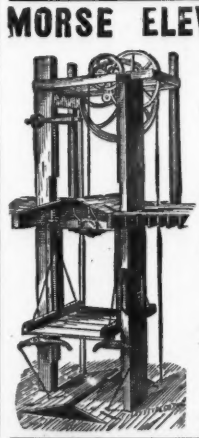

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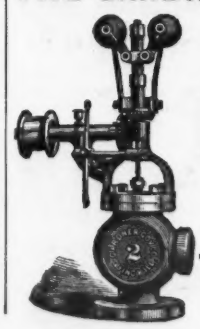

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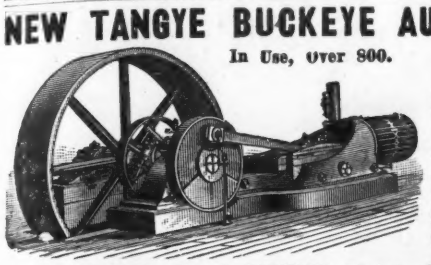

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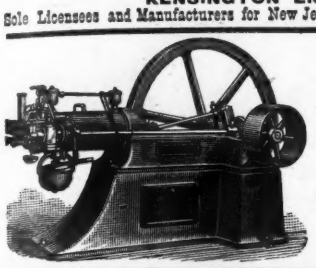

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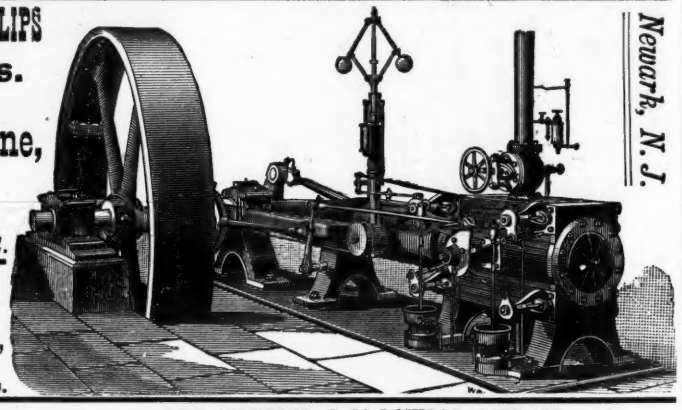

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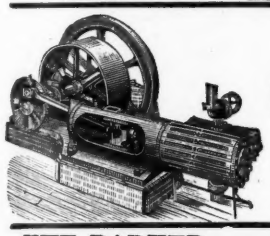

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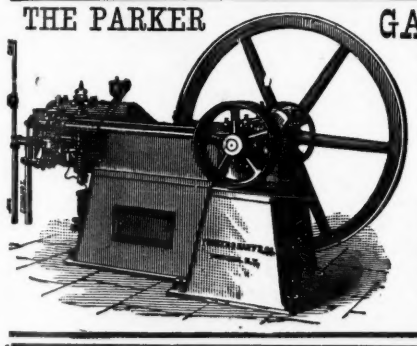

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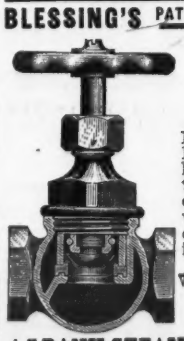

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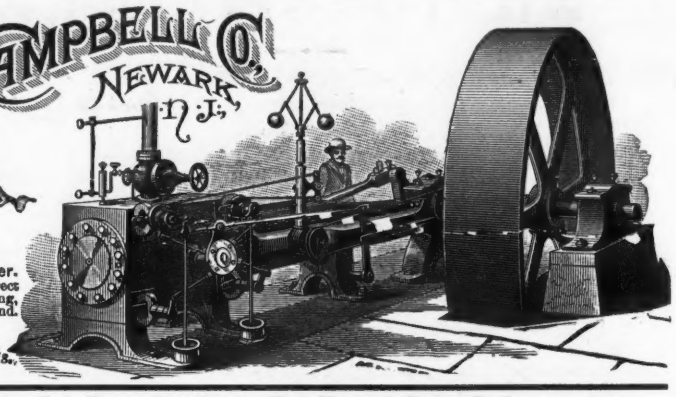

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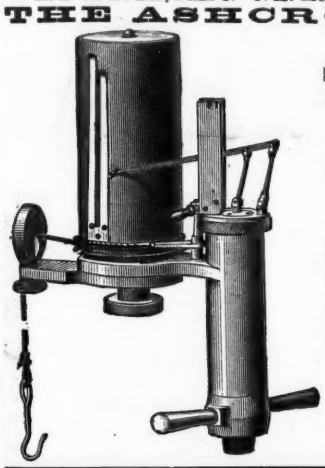

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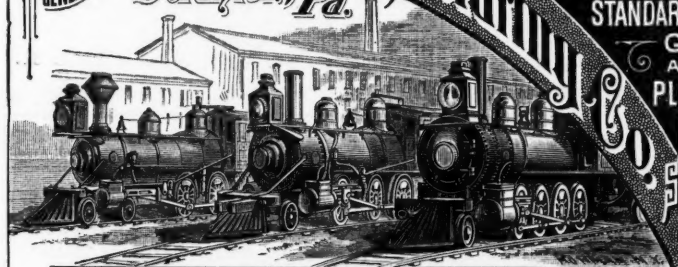

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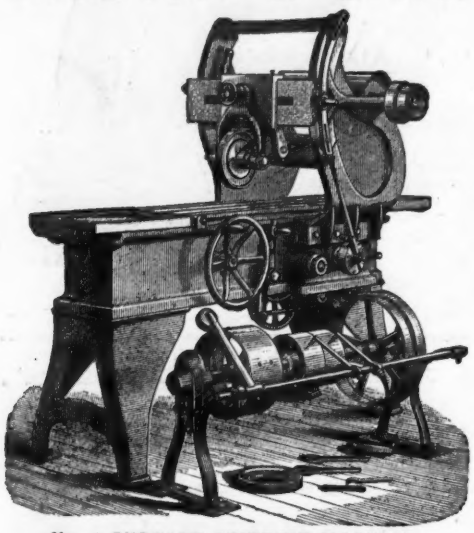


No. 3 SURFACE GRINDING MACHINE.

**This Machine** is designed for flat and true surface grinding and finishing. It is an effective substitute for the operations of filing and stoning. The entire cost of files, and three-quarters of the labor usually expended on these operations are saved, beside obtaining better surfaces upon the work done. For all finished parts of machinery of cast iron or steel, hard or soft, for punches or dies, straight edges, flattening dies, etc , it will prove invaluable, and will produce fine work with little expense.

**It will Grind** 14" wide, 36" long, 10" high, using a 9" wheel.

The countershaft has tight and loose pulleys 8" diam., 4" face, and should run about 276 turns per minute.

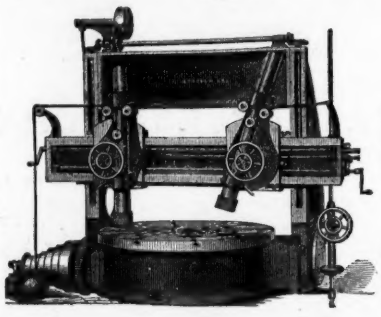
Price includes countershaft, wrenches, etc., all complete, delivered F. O. B. at Providence, R. I. Weight, 2,500 lbs.

We are prepared to furnish this machine lengthened, to grind 5 ft. long. Weight, 3,000 lbs.

ILLUSTRATED CATALOGUE MAILED ON APPLICATION.

# Boring AND Turning Mills,

*5, 6, 7, 8, 10, 12, 14 and 16 FT. SWING.*



## NEW MACHINE,

14—20 ft. Boring and Turning Mill. Housings and upper works arranged to slide back to take in work 20 ft. diameter. Has independent boring and key seating attachment.

## NILES TOOL WORKS

Hamilton, Ohio.

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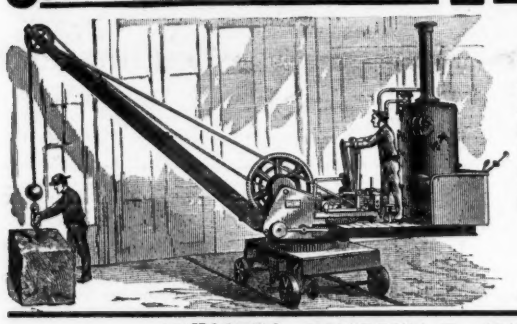

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The most generally useful Crane for shops, contractors, steel mills, etc. All capacities. 2 and 5-ton sizes usually in stock. Send for particulars and illustrated catalogue of all types of cranes.

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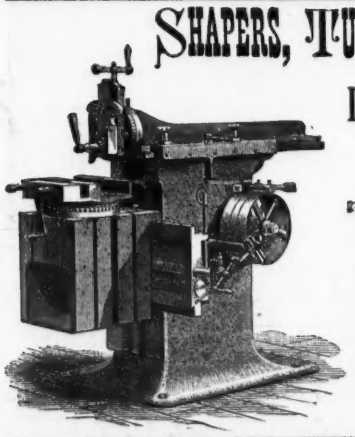
# SHAPERS, TURRET LATHES AND DRILLS,



## LODGE, DAVIS & CO.,

Cincinnati, Ohio.

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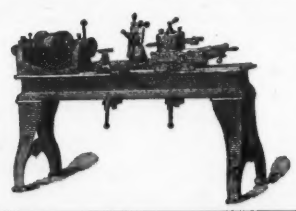
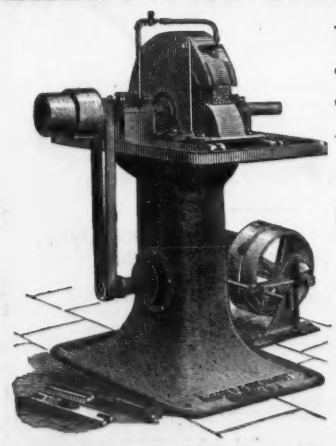


SUCCESSORS TO LODGE, BARKER & CO.

# EBERHARDT'S EMERY TOOL GRINDER



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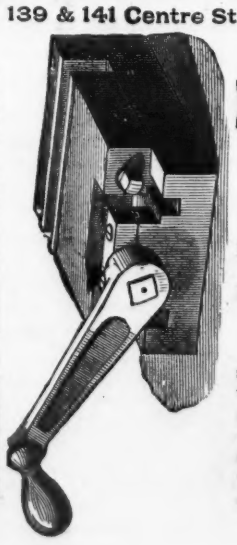
139 & 141 Centre St., New York,

MILLING MACHINE VISE.



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## Machinists' TOOLS,

INCLUDING MILLING MACHINES, DRILL PRESSES, HAND LATHES, &c.

We make three sizes of this Vise, with steel jaws and screws. Screw and cap covered with sheet steel to prevent wear from dust and dirt.

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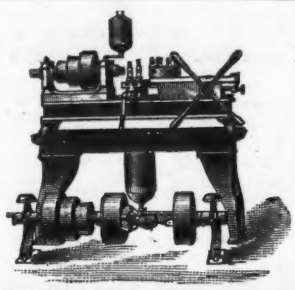

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## Double Head Traverse Drills

For 5/8 in., 3 in. and smaller holes.

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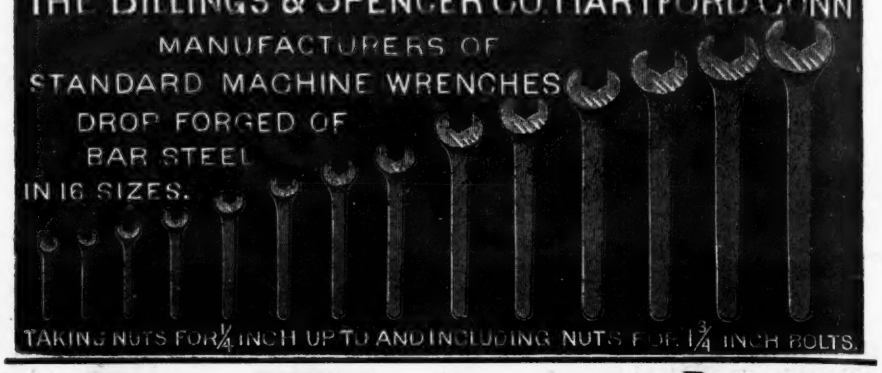

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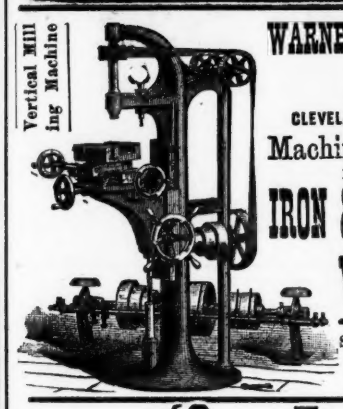

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Machine Tools FOR IRON & BRASS WORK.

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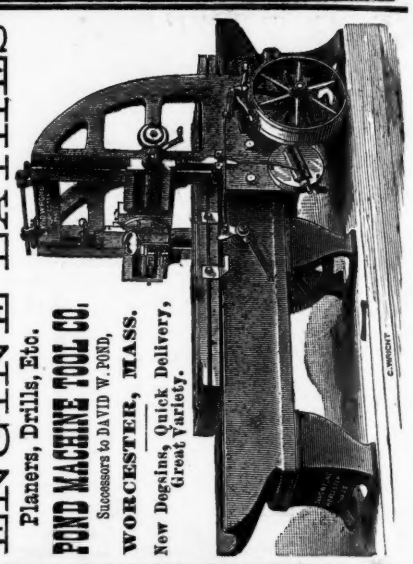

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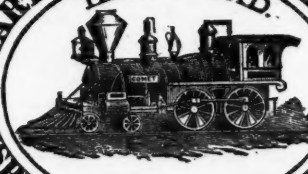

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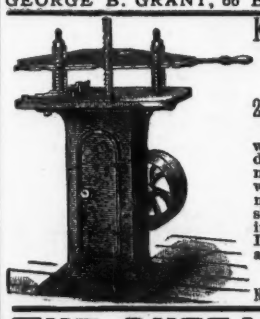

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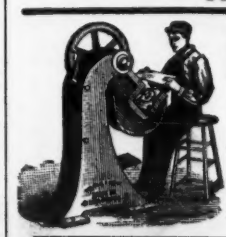

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